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NEW YORK, SATURDAY, OCTOBER 7, 1911.

CONTENTS.

The Dailies

This is the last issue of the ELECTRIC RAILWAY JOURNAL to be published before the Atlantic City convention of 1911. At that convention our headquarters will be at booths 2, 4, 6 and 8, just at the right of the main entrance, and from those headquarters we shall publish our convention dailies. The first daily issue of the ELECTRIC RAILWAY JOURNAL will appear Tuesday morning, Oct. 10. Others will be published on the mornings of Wednesday, Thursday and Friday, and each will contain a report of the proceedings and the other association events of the preceding day. The issue of Saturday, Oct. 14, which will be printed in New York, will contain an account of the proceedings on Friday. We shall be glad to welcome all readers of this paper at our Atlantic City headquarters on the Pier.

Unjust Complaints Against Platform Men

It is the common experience of transportation managers that many of the complaints brought against platform men are so trivial that they merit little or no disciplinary treatment. Nevertheless, it is the part of wisdom to lend a respectful ear to the complainant and to appease him if possible. Nine times out of ten he will leave the office happy if assured that his case will be investigated immediately and that proper discipline will be meted out to the offending employee. The transportation manager, however, should not give his visitor the slightest inkling as to the nature of the punishment, because the chronic kicker is just the kind of person who would use that knowledge to humiliate the same man in the future. A change of run which works no harm to the employee is often the most effective means of giving such unjust complainants the flattering impression that their word is mighty in the councils of the company. As in the days of the patriarchs the proverb, "A soft answer turneth away wrath," still holds true.

Car Destination Indicators

A more or less justifiable complaint about American railroading is that scant attention is given toward the guidance of the stranger. The passenger who enters an interurban railway terminal or joint station of importance for the first time or only occasionally should not be expected to know that the car with the red-and-green lamps is bound for Homeville and the one with the blue-and-yellow lamps for Cottagetown. The familiar practice on steam railroads is to employ a train announcer who bawls out the destination of the train and the number of the platform some five minutes before its departure. This method is costly, and furthermore does not always prevent people who arrive after

the announcement from missing their trains. At some terminals sliding board indicators are in use, but these also require the constant care of a station platform man. A more effective and economical method for keeping passengers posted is offered by electrically operated announcers such as are used at several large electric railway stations in this country and in many steam railroad stations abroad. In one pattern an announcer is placed on each side of every platform and is controlled by the dispatcher or tower man. The announcer is fitted with several shields which are motor-operated by selective control apparatus. These announcers not only give the direction and destination of the train, but also indicate its character, whether local, express or extra fare. Devices of this kind require no platform space, as they can be suspended from the platform roof, where they are also free from tampering by unauthorized persons.

Small Points in Power-Plant Fire Protection

No better evidence of the importance of little things in power-plant fire protection can be cited than the effect which many apparently trifling features of construction or operating practice have upon the insurance rates. Much has been written about the ease with which small points of neglect become magnified to conditions capable of causing serious fire loss, but somehow the happy-go-lucky habits too common in this country continue to reign in far too many installations. We do not propose at this moment to repeat the features of power-plant fire protection which no carefully operated installation should overlook, but it is worth noting that the failure of a company to pass the scrutiny of the insurance inspector's microscopic eye means an additional cost of protection per annum in the shape of increased rates per hundred dollars of station valuation. Thus, in a representative case, the location of the boilers in a brick building adjoining the turbine room, without a parapet on the dividing wall between the two rooms, raised the rate 10 cents per hundred. In another case the existence of cables with combustible insulation grouped too closely near a switchboard added 5 cents to the rate, and in another instance a high wooden roof added no less than 28 cents per hundred per year to the company's premium. The support of a power-station roof by unprotected steel trusses added 2 cents, and the existence of a wooden porch between the operating room and a transformer substation raised the rate a like amount. The carrying of a curtain wall above the sheathing of steel columns added 4 cents to the rate, and in a substation the absence of sand pails cost the company 10 cents more per hundred per year, while the use of non-closing waste cans raised the rate 3 cents. These points illustrate the fact that no matter how much operating companies may fail to realize the increased hazard of neglecting apparently small features of protection, such omissions or sins of commission have a money value to the insurance interests, which must naturally charge higher premiums in the face of increased risks. The lesson should not be lost. If operating men were more generally acquainted with the basic reasons for increased cost of protection more attention would be given to the betterment of conditions inside the plant.

THE CONVENTION ISSUE THIS YEAR

We include in this number our usual "Convention Section," which is complete in itself. The subject selected for treatment this year is the Public Service Railway of New Jersey. This topic was selected partly for its technical interest and partly because of the proximity to Atlantic City of Newark, Camden and other cities in which the Public Service Railway operates cars.

The Electric Railway Journal began the publication of special convention issues about twenty years ago, when it was the custom for the American Street Railway Association to meet each year in a different large city. We felt that it would be a convenience to the delegates to have at the time of such visits recently prepared accounts of the system and practice of the local street railway company or companies. They would thus be able more easily to select those phases of the work which they would like to inspect and would be relieved to a large extent of taking notes on what they saw. This plan has since been followed, except under two sets of conditions. In some years the subject has been expanded to include more territory, as in the convention number of 1906, when the location of the convention in Columbus suggested the desirability of describing the interurban railway practice of the Central West, and in 1909, when the meeting in Denver offered the opportunity for publishing an account of the electric railway systems of the Far West. The other exception noted has been those years in which the association has met at a pleasure resort like Atlantic City when some special topic of live interest has been considered. Thus, in 1907, the convention issue was devoted to the subject of heavy electric traction; in 1908 various topics connected with operating practice were treated, while in 1910 the issue contained a description up to date of the practice followed in promoting traffic.

This year it has been felt that the most fitting topic for treatment would be the Public Service Railway, which is by far the largest electric railway company in New Jersey and one of the largest in the country, because practically every delegate to Atlantic City will pass through Newark or Camden and, if he desires, can easily stop off to make a study of the methods of this corporation. The subject is also rich from a technical aspect, as the railway system combines city, suburban and interurban operation, as the latter is practised in the Eastern States, and in many phases of its work it has been a notable pioneer. The power distribution system of the Public Service Railway is one of the most extensive in the country, owing in part to the fact that the corporation conducts a very extensive lighting business as well as railway business. A high standard of maintenance has been established for its rolling stock, track and overhead equipment. A number of new carhouses have been built during the past few years and the repair facilities have been enlarged and improved. Nor has the company been less forward in the adoption of modern ideas in its relations with its men. All of the carhouses built within recent years have been fitted with special facilities for their comfort and entertainment, and the officers have been indefatigable in their efforts to establish a cordial relation between employer and employee. The

results have been the establishment of a splendid system which it will well repay street railway visitors to New Jersey this year to inspect.

HIGH-TENSION LINE CONSTRUCTION

The growing use of high-tension electrical transmission for railway purposes brings to the engineer a weight of responsibility totally unknown in the earlier days of electric railways. To deal with the ordinary 500 or 600 volts for the trolley wire or with transmission to substations at 10,000 volts or so is a very different proposition from transmission at anywhere from 30,000 to 60,000 volts over long distances. One passes from a region in which construction is of an entirely commonplace character to one in which extreme precautions, not yet fully determined by experiment, have to be taken, and these precautions have to be carried not only through the general design of the line but into the details of construction. In the last resort the success of high-tension transmission depends upon the insulators. At 10,000 or 15,000 volts almost any well-made double or triple petticoat insulator of fair dimensions mounted in the customary way on wooden pins answers the purpose well. When it comes to the higher voltages the real trouble begins.

The most usual fault in line construction is an insufficient factor of safety upon the insulators. There is a very natural tendency to use the smaller and less expensive forms if possible. We have known several railway lines which have experienced considerable trouble by reason of incautious economy of this sort. An insulator may do perfectly well at 15,000 or 20,000 volts, giving so little trouble that it seems entirely secure and yet cause all sorts of difficulties when the voltage is raised to 25,000 or 30,000. In this particular region and above it one begins to find the coronal effects which arise from the imperfection of the air itself as an insulator and greatly weaken the insulation strength of the system. Success in transmission for railway purposes requires a high degree of security against interruptions of service. Nothing is more serious or exasperating than a break-down on a railway transmission line, since it not only interrupts service and stalls the cars, just as it would break down the service of lights and motors on any other system, but it also hopelessly disorganizes the schedule and causes a long period of bad service, much longer than follows an actual interruption of similar length in the case of an ordinary commercial power system.

In the construction of a high-tension railway transmission the first great problem that arises is the nature of the supporting structure. Modern practice in general high-voltage work has tended to the use of lines carried on steel towers similar to windmill towers, the whole structure being made of steel, including cross-arms and pins. The tower construction, from the height and stability of the supports, gives opportunity for long spans, averaging say 500 ft. or 600 ft., with the collateral advantage of a relatively small number of insulating supports, which is a very good thing in itself. Wooden poles such as are used in the majority of railway transmissions have customarily been placed at a little over 100 ft., running forty or fifty poles to the mile. Either system can be made thoroughly successful for high voltage, but there is a radical difference in the characteristics of the insulation as commonly employed. With the tower construction the full earth potential is carried clear up into the interior of the insulators, and the insulators therefore have obviously to bear the burden of the insulation. In wooden construction the poles, cross-arms and pins are not without insulating value, and in dry weather the earth potential is far removed from the lines. In tower work or lines on steel poles with steel cross-arms and pins one must therefore figure the factor of safety of the insulator so that there will be no break-down even although the earth is virtually within an inch or two of the live conductor. One has to follow out the maxim attributed to Andrew Carnegie of putting all one's eggs into one basket and then watching that basket.

Much of the trouble which has at times been experienced with wooden transmission lines arises from failure to realize the changed conditions that occur when passing from modern voltages to those high enough to produce marked coronal effects. If these exist on a steel-built line there is a strong likelihood, unless the factors of safety on the insulator are exceptionally high, of a flashing over which then and there puts the line out of business. With wooden construction, even when the cross-arms and pins are boiled in insulating material as they should be, there is always a chance, unless the same precautions are taken with the insulators, that the coronal discharges, which in ordinary weather seem perfectly harmless, may gradually tend to break down the wooden insulation between wire and wire and earth and earth. This action is not a violent one, but often gradually produces an effect which has been aptly termed a "digestion" of the pins, and is accompanied as well with a burning of the cross-arms and similar destructive effects.

Now, the moral of this tale is really perfectly simple. If the insulators are so proportioned that in and of themselves they are sufficient to hold up the working voltage under all conditions, it makes no particular difference what material is used to support them, and material becomes merely a matter of convenience and cost. If the insulating power of the insulators themselves is insufficient, that is, if too small a factor of safety over and above the working voltage is allowed, then trouble is likely to be experienced with any kind of supporting structure, immediate and violent if steel is used, gradual and exasperating in the case of wood. Not infrequently steel pins are employed on account of their greater convenience and strength where large insulators are to be supported, but this does not alter the general insulation materially. If the insulators themselves are strong enough and as good as they should be in an all-steel structure, the nature of the poles and cross-arms cuts very little figure. The long and short of the whole matter is that if one provides suitable insulating supports for the high-tension wires he is safe. If he scrimps on his insulators he is pretty certain to get into trouble whatever kind of a pole line he uses. This theoretical deduction is amply borne out by the results of practice. High-tension lines up to 50,000 or 60,000 volts are successfully operated on all kinds of supporting struc-

tures. In passing it should be noted that very admirable pole lines may be made by the use of latticed steel poles instead of steel towers. Where a single circuit is to be employed these poles can be spaced at 200 or 300 ft. and produce a considerably cheaper line than the tower construction. At the same time they possess all the mechanical strength and permanence of the latter at a price which in some sections would make them well worth while. Failing in this, a sturdy wooden construction, with poles spaced twenty-five or thirty to the mile, provides absolute security, at least in most climates. Such construction is used very successfully in California, and can be applied with equally good results elsewhere.

As regards the insulators themselves, the main thing is that they should neither break down nor spill over, even in a fine spray, at anywhere near the working voltage. A factor of safety of 2.5 is none too small. As a matter of fact most pin-type insulators will flash over under adverse conditions at or near 100,000 volts, so that they should be employed with caution when the working voltage rises to 40,000 or 50,000. The success of the modern extremely high-voltage lines has practically been brought about by the introduction of the suspension insulator, in which a sufficient number of disks can be put in series to raise the breaking-down point even in bad weather high enough to permit of operation certainly up to 100,000 volts and probably considerably beyond this figure in case of need. Up to 60,000 volts or thereabouts pin insulators are actually in successful use, but at this figure they reach the point where the factor of safety is rather too low, and in unfavorable climates it would be better here to pass to the suspension type. All insulators should be rigorously tested before installation, and if this is done there will be comparatively little trouble afterward unless the voltage is raised, as it sometimes is. With these precautions rigidly carried out the nature of the line construction ceases to be an important matter. Precautions like grounding the steel pins, when these are used, turning up the ends of the wires and other similar methods which have been employed on different occasions do not have much significance if the insulators themselves are fully adequate. They may serve as palliatives in the re-equipment of somewhat inadequate lines for higher voltage.

The worst external foe of power transmission for any service is lightning. Sufficiently good results have been obtained by a strong steel cable run well above the working conductors and grounded at every pole to indicate that the precaution is in exposed regions worth the while. The principal service of the so-called lightning arresters is to keep violent discharges out of the station apparatus, which as a whole they are fairly successful in doing. Finally, it should be remembered for the encouragement of transmission that experience shows that with proper construction high-voltage lines are subject certainly to no more trouble than those at moderate tension, perhaps to rather less. This is owing in part usually to somewhat less violent surging, but more to the high margin of insulation necessary, which minimizes the effect of minor rises of voltage whether they are produced by lightning or from other line phenomena.

THE VALUE OF CAR METERS

The paper on "Tramcar Meters" by Messrs. Cunliffe, of Manchester, which is published in abstract in this issue, gives the results of a thorough study of the merits of different types of car meters and their field of usefulness. It is customary to consider the car meter almost exclusively as a check upon the efficiency of the motorman. The authors of this paper, however, have attempted to broaden its usefulness by endeavoring to gage from it the economical life of car, track and power transmitting equipment by noting the increased energy losses rather than the extent of the wear.

The experiments were begun in 1907, at which time so little was known about the general reliability of car meters that the authors were obliged to use every type then available, namely, watt-hour meters, ampere-hour meters and the German clock or time-meters. The readings of the first were theoretically self-contained, those of the second were completed by a volt-hour meter per feeder section, while those of the third were used principally for checking purposes. The first point which the tests showed was that, owing to its greater reliability in car service, the ampere-hour meter gave really a closer record of the actual energy consumed than the type of watt-hour meter used. The second principal point determined was that there was no very close relation between the readings of the energy meters and the indications of the time meters. In fact, the record of the excellence of the men with one type of registers did not correspond with those made with the other, due probably in large part to differences in the rate of acceleration.

It does not follow from these tests in Manchester, however, that time-meters are a failure in the improvement of car operation. Experience with them in Berlin and elsewhere has given abundant proof that the drawbacks cited can be greatly reduced, if not made negligible, by a system of discipline which checks the abuse of equipment and fixes the minimum or maximum limits of controller or coasting time according to the conditions on each route. As a matter of fact, the mere presence of a checking device of any kind will exert temporary good at least, but the best meter conceivable will not give permanent benefits unless proper education and possibly some system of recognition for the economical men are applied to keep them from relapsing into slipshod operation of their controllers.

The possibilities of the use of the records so obtained for checking the economical life of equipment, as in Manchester, seem to us of somewhat doubtful value. The economy of additional generating or distributing capacity, better bonding circuits or more efficient motor operation should be demonstrable more directly than by an analysis of the readings of hundreds, even thousands, of car meters in addition to the recording instruments of the generating plant and substations. It is probable that the same improvements would have been obtained at less expense by intelligent observation of equipment. The company that maintains its physical properties in first class condition is not likely to suffer much from leaks in energy from defective equipment.

COMPARISON OF OPERATIONS OF INTERBOROUGH AND BROOKLYN SYSTEMS

Publication of the annual reports of the Interborough Rapid Transit Company of New York and the Brooklyn Rapid Transit Company for the year ended June 30, 1911, permits a comparison of the recent operations of these large properties at an opportune time. As the relative position of the companies in the transportation system of Greater New York will be changed by the new subway program, it is interesting to study the main differences in present earnings, expenses, trackage and passengers carried. The comparisons are of greater interest because the accounting systems of the companies are presumably now substantially uniform in compliance with the rules promulgated by the New York Public Service Commission, First District, which has jurisdiction over the Interborough company and the subsidiary operating railways of the Brooklyn system. The Brooklyn Rapid Transit Company is a business corporation controlling a number of operating railways.

During the last fiscal year the Interborough company reported gross operating revenue of $29,767,352. The Brooklyn system reported gross revenue from operation of $21,986,543. The Interborough revenues are thus 35.4 per cent greater than those of the Brooklyn system. A further division may be made in the case of both companies. The Interborough revenues are received from the Manhattan Railway (elevated) division and from the subway division. The former contributed $15,414,146, or 51.8 per cent of the total; the latter furnished $14,353,206, or 48.2 per cent. The passenger earnings of the Brooklyn system, comprising 97.1 per cent of the gross revenue from operation, were furnished by the surface and elevated divisions in the following proportions: Surface, $12,976,397, or 60.8 per cent; elevated, $8,377,966, or 39.2 per cent. The Interborough gross revenues as stated included the amount of $843,415, comprising other street railway operating revenues, or 2.8 per cent of the total.

When we take up operating expenses it is found that notwithstanding the great difference in gross revenue the expenditures of the two companies are nearly the same, being $12,368,981 for the Interborough company and $12,166,367 for the Brooklyn system. The operating ratio, of course, shows a wide discrepancy. For the Interborough company it was 41.55 per cent and for the Brooklyn system it was 55.34 per cent.

Differences in the maintenance expenditures may be considered first. The Interborough company spent for maintenance of way and structures $1,581,750, or 5.3 per cent of gross operating revenue. The corresponding expenditure by the Brooklyn system was $1,423,108, or 6.5 per cent of the total revenue from operation. On maintenance of equipment the Interborough company spent $2,562,800, or 8.6 per cent of gross revenue, while the Brooklyn system shows a total outlay for this purpose of $2,125,580, or 9.6 per cent of gross revenue. The Interborough company spent on the subway about 44 per cent of its total expenditure for maintenance of way and structures and about 61 per cent of its total expenditure for maintenance of equipment. The Brooklyn system does not show the division of expenses between the surface and elevated lines. Combining the maintenance expenditures, it is found that the Interborough company spent on both divisions of the system a total equal to 13.9 per cent of gross operating revenue, or 33.5 per cent of the total operating expenses. The Brooklyn system spent for maintenance the equivalent of 16.1 per cent of gross revenue, or 29.2 per cent of the total operating expenses.

On its transportation expenses the Interborough company expended $7,110,510, an amount equivalent to 23.9 per cent of gross operating revenue, or 57.5 per cent of the entire operating expenses. Differences between the general operating expense accounts in the annual reports of the two companies should be mentioned at this point. The Brooklyn system shows the following expenditures for 1911: Operation of power plant, $1,339,552; operation of cars, trainmen's wages, $3,714,683; operation of cars, other expenses, $1,584,180. The aggregate of these is $6,638,415, which is equivalent to 30.2 per cent of total revenue from operation and 54.6 per cent of the total operating expenses.

Other detailed expenditures shown in the Brooklyn report include damages, which cost $750,854, or 3.4 per cent of total revenue from operation, and legal expense in connection with damages, which amounted to $232,616, or 1.1 per cent of total revenue from operation. This is a total for these two items equivalent to 4.5 per cent of the total revenue from operation. It compares with the low cost reported by the Interborough company of 1 per cent of the gross operating revenue. On account of the dissimilarity between the physical conditions of the companies, these results are not fairly comparable.

General law expenses of the Brooklyn system aggregate $60,115, or 0.3 per cent. Other general expenses were $707,369, or 3.2 per cent. Freight and mail expenses amounted to $227,004, or 1 per cent. Expenses of the American Railway Traffic Company are stated as $1,306. The aggregate of the last four items mentioned is $995,794, or 4.5 per cent. The Interborough company reported general expenses of $1,112,175, or 3.7 per cent of the gross operating revenue. Its traffic expenses, making the final item in the total operating expenses, were $1,746.

The number of passengers carried by the Interborough lines was 578,154,088. As the Brooklyn system carried 571,881,446, the totals are very near together. The Interborough total, however, represents either revenue traffic alone or an amount of transfer traffic that is negligible, while the Brooklyn total includes its large transfer business. There is a material difference in the trackage operated by the two companies. The Interborough company shows a total of 203.3 miles of single track as compared with 613.2 miles for the Brooklyn system. The Interborough trackage is divided as between the subway, 85.3 miles, or 41.9 per cent of the total, and the Manhattan Railway, 118 miles. The Brooklyn mileage is divided as between the surface lines, 541.9 miles, or 88.2 per cent of the total, and the elevated lines, 71.3 miles. Per mile of total track the Interborough company carried an average of 2,843,863 passengers, as compared with 932,618 for the Brooklyn system. There is a still greater difference in the gross earnings per mile of track, which averaged $146,421 for the Interborough company as compared with $35,855 for the Brooklyn system.

Motor Cars for the Spiez-Frutigen Railway

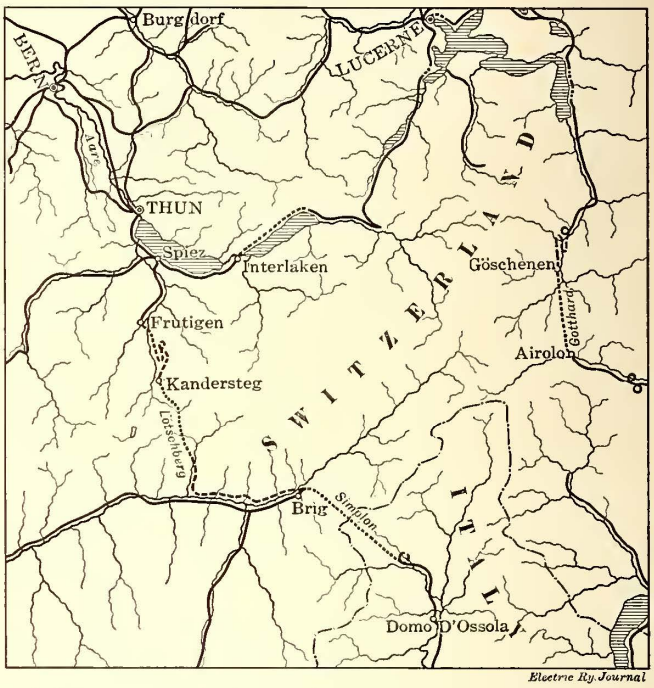
This Railway Is the Most Important Now Being Electrically Equipped in Switzerland

In the Electric Railway Journal of July 29, 1911, an article was published regarding the 2000-hp single-phase locomotive recently built by the Siemens-Schuckert interests for the Spiez-Frutigen section of the Lötschberg Railway. As shown in the accompanying map, this Frutigen line is the most northerly of three sections between Spiez, in Switzerland, and the Italian end of the Simplon tunnel. The route length of the section is 8.37 miles with a maximum grade of 1.55 per cent. The middle section is the Lötschberg (part tunnel) railway, 45.3 miles long with a maximum grade of 2.7 per cent, and the Simplon railway, also part tunnel, is the third section. The completion of the two more northerly sections will provide a cut-off between Bern and northwestern Europe to the Simplon tunnel, which can now be reached from Bern only by a somewhat circuitous route.

The average grade of the Spiez-Frutigen line is 1.1 per cent, and 40 per cent of it is on curves with a minimum radius of 300 meters (984 ft.). The track construction in open country consists of 72-lb. rails with seventeen oak ties per rail length of 39 ft. on tangents. In the tunnel, which is 5261 ft. long, the rails weigh 84 lb. per yard, and are fitted with chairs. The total length of single track is 14 miles. The overhead construction is of the Siemens-Schuckert double catenary type. The trolley current is delivered at 15,000 volts, 15 cycles, the latter being the frequency recommended as standard by the Electrification Commission of the Swiss government.

GENERAL EQUIPMENT

As stated in the issue of this paper for July 29, the first order for rolling stock comprised three motor cars and two 2000-hp locomotives. The motor cars will be operated to Kandersteg upon the completion of the Lötschberg tunnel. The locomotives are used to handle freight between Spiez and Frutigen, but they were designed for eventual use in the Lötschberg tunnel service to Brig.



Spiez-Frutigen Railway—Route and Connecting Lines

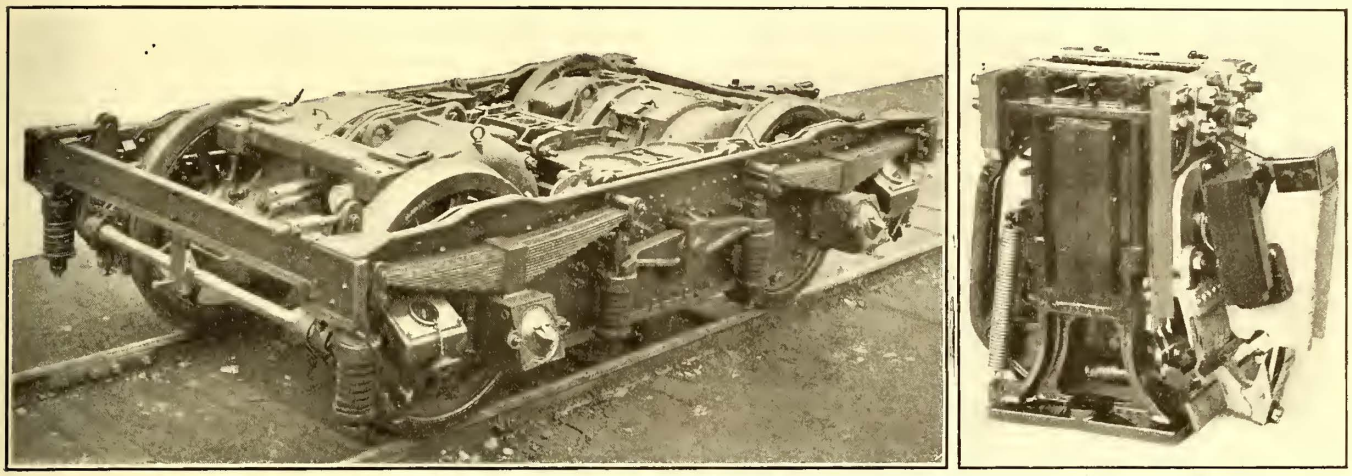
Spiez-Frutigen Railway—Standard Two-Compartment Motor Car

MOTOR CARS

The motor cars are of the double-truck type. They have smoking and non-smoking compartments, each seating thirty-two passengers; a toilet room in the middle of the car and two inclosed cabs for the motorman. The passengers' platforms separate the cabs from the rest of the car. A short end platform is also provided in front of each cab for the use of the crew in stepping from car to car during train operation. The cars are 66.6 ft. long over the buffers. Each truck is designed to carry two motors having an hourly rating of 230 hp each, making the possible motor capacity per car over 900 hp. However, only two motors, which are carried on one truck, are used, as half-capacity is enough to satisfy the present operating requirements.

It was specified that a fully equipped car should be capable of running at the rate of 27.9 m.p.h. for at least an hour and at a maximum speed of 43.4 m.p.h. The continuous tractive effort developed at the diameter of the wheels for an hour was to be at least 11,000 lb. during running and 16,280 lb. at starting. A motor car must therefore be capable of hauling a total load of 240 metric tons at 45 km an hour (27.9 m.p.h.) on a 1.55 per cent grade, or 160 tons on a 2.7 per cent grade. The cars are equipped with lighting, heating and sanding devices. The wiring is so arranged that the main circuits will be unaffected by the change to four-motor operation.

The current collectors can be operated for clearances over the height of the rails varying from 15 ft. 9 in. to 23 ft. 1 in. Under certain conditions the contact piece can be lowered to a point 14.7 ft. above the rails. The width of the sliding bow is only 3.9 ft., on account of the clearances which will have to be met in the Lötschberg tunnel;



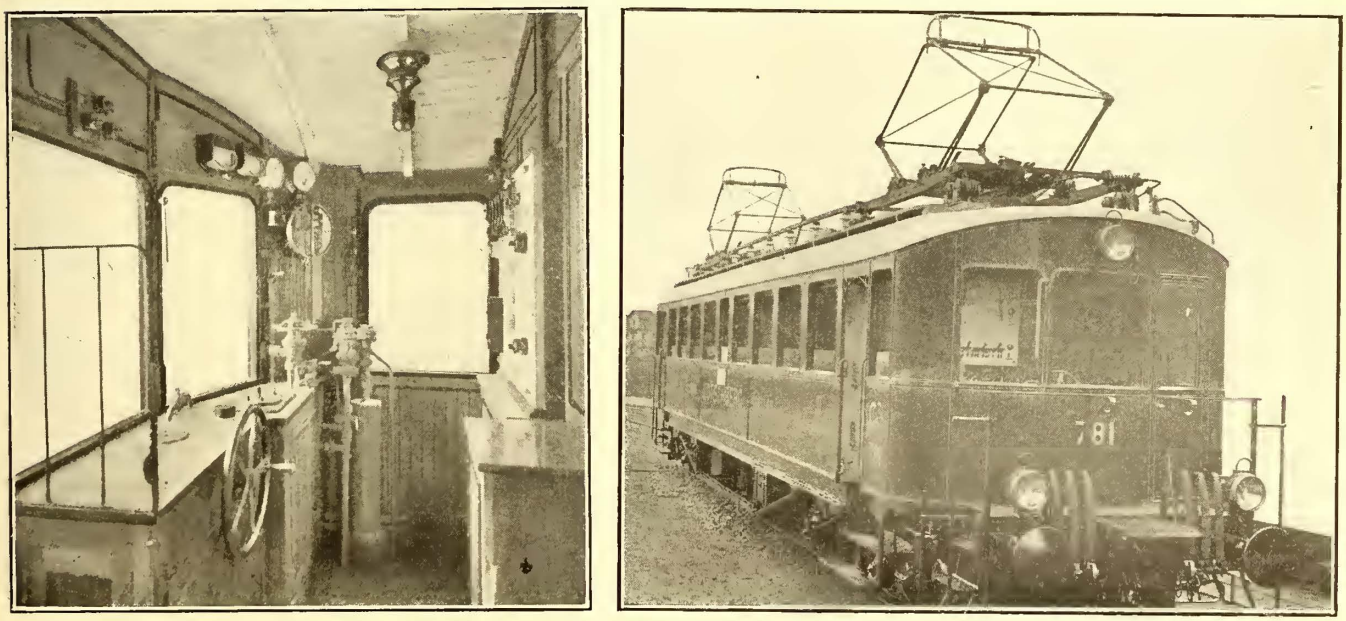
Spiez-Frutigen Railway—Motor Truck and Control Contactor

independent hand brakes for each truck and with the Westinghouse air brake. Every wheel is fitted with pneumatic sanding apparatus which can be electrically thawed if necessary. There are six electric signal lamps, besides oil lamps and candles for emergencies.

DETAILS OF ELECTRICAL CAR EQUIPMENT

The electrical equipment per car is divided into two similar sets made up as follows: high-tension oil switch, oil transformer, two motors with voltage regulator and controller, choke coil and mechanical draft apparatus. The parts common to both groups are the two bow pantograph current collectors, the lightning-protection devices, the compressor which supplies the brake cylinders, sanders, signal pipes and the cylinders through which the pressure of the pantographs against the trolley wire is regulated; also a motor-generator lighting set, storage batteries and the

therefore the trolley wire must not be staggered more than 15.7 in. from the center line of the track. The pantographs are mounted on sets of grooved high-tension insulators. The pantograph frame is adjusted for important variations in height by means of compressed air and chain transmission, but it is lowered by its own weight. The contact bow reverses automatically, and owing to its small mass it also adjust itself easily to minor irregularities in the wire. The contact piece is made of aluminum and contains two lubricated grooves. It can be replaced merely by loosening a few screws.

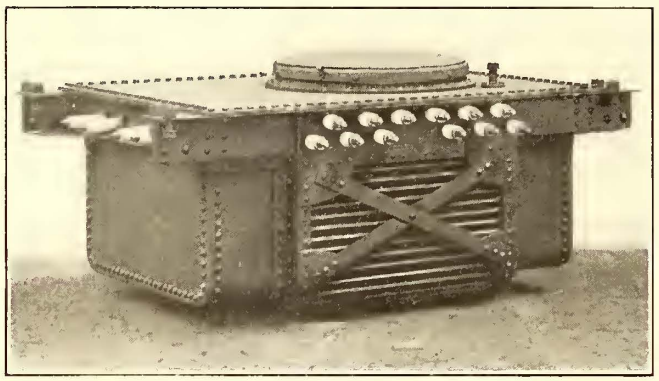


Spiez-Frutigen Railway—Motorman's Cab and End View of Car

The protection against lightning and other high-tension discharges consists of a horn arrester which is placed on the car roof and grounded to a 2900-ohm, oil-immersed resistance, which consists of forty-eight pieces of carborundum. A choke coil is placed in the high-tension cir-

cuit just before the entrance to the high-tension chamber.

The high-tension oil switches open and close the circuit to the car transformer. These interruptions are made at four places on account of the high voltage. These switches are controlled from the motorman's stand by means of a switch-in coil, although they could be operated by hand in emergencies. They are so constructed that a high-tension

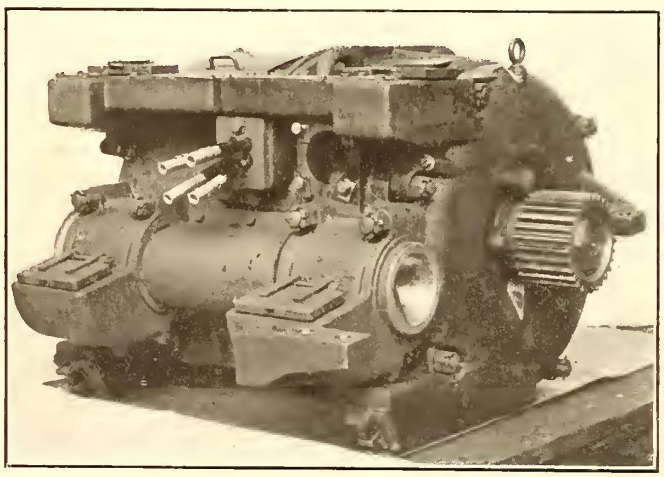


Spiez-Frutigen Railway—Main Transformer

resistance is kept in circuit temporarily to prevent the immediate application of full voltage on the transformers. The high-tension switches are cut out of circuit by means of a relay which is actuated through a push button at the motorman's stand.

All high-tension apparatus is placed in a separate compartment under the middle of the car body. The mica-insulated high-tension circuits are led to this compartment from the roof via the toilet room through a grounded brass pipe which is filled with cable insulation. The high-tension compartment can be opened only when all high-tension circuits are opened, and the pantographs cannot be raised while the door of this compartment is open.

The transformers are of the oil-insulated, core type with an hour rating of 450 kva. They are mounted under the car to obtain the benefit of air cooling during running. If necessary, the primary or high-tension winding can be operated at 7500 volts instead of 15,000 volts. The secondary coils are divided for a large number of running steps, in addition to which two auxiliary coils are provided



Spiez-Frutigen Railway—Single-Phase Motor

for the excitation of a part of the motor compensating winding to act as a commutating winding.

Each half of the electrical equipment has ten contactors, six of which are used for running and four for reversing. Each set includes two contactors for the circuits which excite a part of the motor compensating winding, as noted in the foregoing paragraph.

MOTORS AND CONTROL

The motors are of the eight-pole Siemens-Schuckert series—type WBM—300 geared 1:3.45. The top to bottom dimension of the motor housing is 36.6 in., which allows a clearance varying from 6.3 in. to 5.9 in., according to the wear of the wheels. Consequently, with a spring depression of 1 in. on one side, the clearance will be within the limits of 3.93 in. permitted by the Swiss government.

The motors have only two windings on the stator structure. One is the exciter winding which is placed in two slots of every pole and which overcomes the armature magnetomotive force locally to provide the main field; the other is the actual compensating winding which is placed in the remaining pole slots. There is no special commutating-pole auxiliary winding. On the contrary, the auxiliary commutating field is created by the external excitation of a part of the compensating winding. This combination of the exciting and compensating winding makes it possible to use a separate exciter winding for each direction of running without requiring extra copper. This arrangement has the further advantage of making it possible to use two ordinary contactors per motor instead of the reversers.

In every control step except the first the transformer current is taken through two simultaneously operated contactors, whence it is led to the ends of a choke coil. The latter prevents the current from being interrupted in going from step to step while permitting it to divide between the two contactors.

Energy for the several auxiliary purposes is also taken from the transformers. The current for control is taken at 178 volts, for the compressor and ventilator motors at 109 volts, and for the heating circuit at 300 volts. Current for the car and signal lamp lighting and for the initial operation of the electromagnetic multiple-unit control is obtained by means of a 1.2 kw, 35-volt, d.c. motor-generator set and a storage battery of 81 amp-hours capacity.

GERMAN ELECTRIC RAILWAY CONVENTION

The German Street & Interurban Railways Association held its annual meeting in Berlin from Monday, Sept. 18, to Friday, Sept. 22. The members and delegates were received in the Imperial Parliament Buildings on Monday evening. The next morning reports were presented from the various committees. Among the subjects dealt with were "The Standardization of Holes in Fishplates and Rails," "Fares," "New Grounding Regulations," "The Employment of Motor Vehicles on Light Railways" and "The Shape of Rail Grooves." After the Tuesday morning session the members and their friends were taken over the lines of the Berlin City Railways. They also visited the works of the Allgemeine Elektricitäts Gesellschaft at Oberspree. In the evening a conversazione was given by the city authorities in the town hall. On Wednesday morning five papers and one report were considered, and in the afternoon the visitors were conveyed by automobiles to the Siemens-Schuckert works at Nonnendamm. In the evening the members were entertained to dinner by the Allgemeine company and Siemens & Halske in the great hall of the Zoological Gardens. Thursday was devoted to excursions by special train and tramcars to Potsdam and Charlottenberg. In the afternoon special steamers took the visitors along the Havel Lakes to Wannsee, whence, after dinner, they all returned to Berlin by special train. The last meeting took place on Friday. The afternoon was left free, and the proceedings ended with a dinner and reception given by the Grosse Berliner Strassenbahn.

The National Board of Fire Underwriters has just issued the rules and requirements for electric wiring and apparatus as amended for the year 1911. Among the data of particular interest to electric railways are the rules relating to the car wiring and equipment of cars and carhouses.

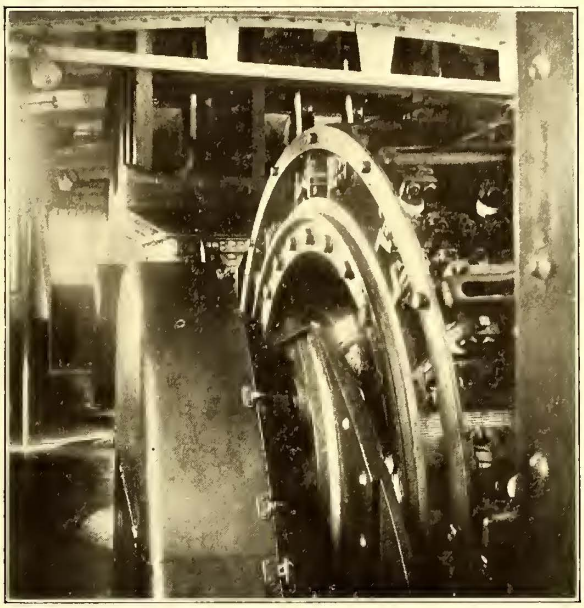
SINGLE-PHASE LOCOMOTIVE FOR MIDI RAILWAY, FRANCE

The accompanying illustrations show the exterior and interior of the experimental single-phase locomotive built by the Allgemeine Elektricitäts-Gesellschaft, Berlin, for the Midi Railway, France. A reference to the electrification plans of this railway was published in the Electric Railway Journal for June 3, 1911, on page 692. This locomotive was built for 15,000-volt, 16⅔-cycle operation over a standard gage line to comply with the following specifications: Length of locomotive over the buffers, 13,140 mm (43 ft.); greatest width, 3150 mm (10 ft. 4 in.); greatest height, 425 mm (13 ft. 11 in.); total wheel base, 9600 mm (31 ft. 6 in.); fixed wheel base, 3600 mm (11 ft. 9 in.); driving-wheel diameter, 1310 mm (4 ft. 3 in.); trailing-wheel diameter, 8500 mm (33 in.); side play of the two trailing axles, 55 mm (2.2 in.); weight on driving axles, 18 metric tons; weight on trailing axles, 15.5 tons; total weight, 85 tons; weight available for adhesion, 54 tons; maximum speed, 75 km an hour (46.5 m.p.h.); maximum drawbar pull, 12,500 kg (27,500 lb.); continuous drawbar pull for one hour, 8000 kg (17,600 lb.).

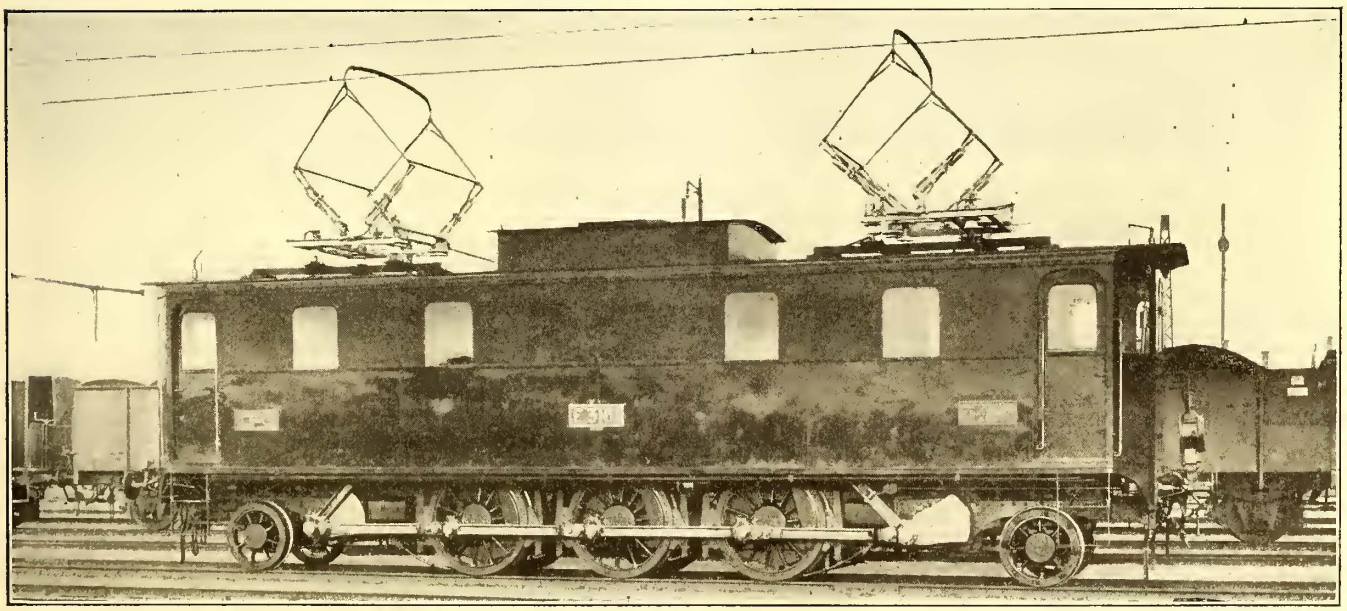
The two motors, which have an hour rating of 800 hp each, operate with the driving rod set at an angle of 45 deg. to the horizontal on two intermediate crankshafts placed outside the driving axles. The moment of inertia of the locomotive has been kept comparatively small by placing the two motors and the main transformer in the center of the locomotive. This matter was important, as the fixed wheel base was specified not to exceed 3600 mm (11 ft. 9 in.). The leading axles permit the locomotive to travel easily around curves of 160-m (525-ft.) radius.

Only the two outer coupling axles are rigidly fixed to the frame, in order to obtain flexibility on curves. The center coupling axle has a side play of 20 mm (0.8 in.) on each side so that it can run on the outer rails on sharp curves and thus is guided independently of the frame. The locomotive is guided by the two front axles on curves of 250-m (820-ft.) radius or more. On curves of less than 250-m radius the leading coupling axle is drawn off the outer rail, leaving the locomotive to be guided by the front running axle only. Suspension springs support the locomotive at six points. Each running axle is connected to the adjoining coupling axle by means of a bell crank. The ends of the coupling rods are provided with non-adjustable bushings, but the motor bearings and intermediate crankshaft bearings may be adjusted for wear.

The upper part of the locomotive is completely inclosed. The main transformer is mounted in the center on double T-irons arranged between the main frame covers. The high-tension oil switch and a part of the control gear are mounted on a special frame over the transformer. The central part of the roof has hinged doors so that the high-tension oil switch or the contactors can be taken out after the removal of the apparatus above it. In like manner doors are provided in the roof over the motors. The motorman's cab at each end contains the necessary measuring instruments and operating gear. An aisle on one side of the locomotive gives access from the cabs to all apparatus. End gangways allow the attendants to pass from the locomotive to the train.



View of Motor and Contactor Cells



Single-Phase Locomotive for Midi Railway, France

The operating equipment of this locomotive, which has recently been completed, includes hand brakes, Westinghouse air brakes, air sanders and whistles, oil signal lamps and two speed indicators.

Arch-Roof Cars Built by the Chicago Railways

These Cars, Which Are Being Built in the Company's Shops, Are the First Arch-Roof Cars for Use in Chicago. They Were Designed Jointly by the Railway Company's Engineers and the Board of Supervising Engineers, Chicago Traction.

The engineering and mechanical departments of the Chicago Railways Company have just completed the first car of a lot of 215 double-end, prepayment, arch-roof, steel-underframe cars which are to be built in the railway company's shops. Exceptionally complete specifications and detail drawings were prepared previous to the construction of this first car with a view to obtaining a stanch car of comparatively low weight. The designing and car construction work is being done under the direction of the Board of Supervising Engineers of Chicago Traction. The Chicago Railways Company has about 1600 cars, of which 1328 are arranged for pay-as-you-enter fare collection. The pay-as-you-enter cars are of three types—the all-steel cars built by the Pressed Steel Car Company and described in the Electric Railway Journal for Aug. 28, 1909, page 312; the steel-underframe, wood-body cars built by the Pullman Company and described in the issue of this paper for Nov. 7, 1908, page 1326, and the 328 wooden cars originally built by the St. Louis Car Company, which were rebuilt by the Chicago Railways Company and were described in the Electric Railway Journal for Nov. 27, 1909, page 1092.

Chicago Car—Exterior View

The general characteristics of the new cars now under construction at the railway company's shops compare with those of the three other types of cars as follows:

Built by—	Company Shops.	Pullman Co.	Pressed Steel Car Co.	St. Louis Car Co.
	Ft. In.	Ft. In.	Ft. In.	Ft. In.
Length over bumpers	44 0	49 2	49 2	41 0
Length over end panels	31 2	32 5	32 5	28 0
Truck center distance	19 5	20 1	20 1	17 5
Truck center to bumper	12 3½	14 6 5/16	14 6½	11 9½
Width over drip rails	...	8 7	8 6½	8 6
Width over belt rails	8 6	8 7½	8 8	8 6
Width over guard rails	8 7½	8 9	8 9	8 6
Height top of rail to top of trolley board	11 9	11 8	11 8	11 4
Height top of rail to sill	2 8¾	2 7½	2 9⅝	2 8
Window post spacing	2 6	2 8	2 8	4 6
Seating capacity	40	40	40	36
	Lb.	Lb.	Lb.	Lb.
Weight of body and accessories	21,390	24,000	26,420	21,100
Weight of car complete	43,558	53,000	52,700	46,000
Weight of four motors without gears and cases	7,800	9,564	9,564	9,656
Total car weight per horse-power	311.1	331.3	329.4	287.5
Total car weight per seat	1,089	1,325	1,318	1,277
Horse-power per car at 500 volts	140	160	160	160

Inasmuch as the new cars have been designed with a view to saving all unnecessary weight the following subdivision of the total weights is of interest :

	Lb.
4 motors at 1,950 lb	7,800
4 gears at 220 lb	880
4 gear cases at 125 lb	500
4 axle collars at 20 lb	80
2 truck frames at 3,000 lb	6,000
4 axles at 400 lb	1,600
8 wheels at 525 lb	4,200
2 truck guards at 125 lb	250
Oil, grease and waste	80
Running gear	21,390
Body and fittings	22,168
Total	43,558

UNDERFRAMING

The underframe of the new car is of particular interest. Its principal members are two built-up side girders. Plate-girder side sills were preferred to the truss form of side construction because of the greater stability obtained and because with girders it is not necessary to cut the window posts to recess the top member of the truss. Each side girder is made up of one 3/16-in. x 18-in. plate reinforced on the outside along the bottom by a 2¼-in. x 2½-in. x 5/16-in. angle, and at the top by one 2-in. x 5/16-in. bar extending the full length of the girder. Additional top bars, stiffener angles and plates are added where reinforcement is necessary. The bottom outside angle carries a Norway pine subsill to which the body posts are fastened. The side girders are supplemented by one center floor tee made up of two 2-in. x 2-in. x 5/16-in. angles and by two intermediate sills, each made up of two 2-in. x 2-in. x ¼-in. angles. Part of the cross-members are 3-in. I-beams weighing 5.5 lb. per foot and part are 4-in. 6.25-lb. channels. Two underframe crossings of 3-in. 5-lb. channels are provided at each body bolster. The end sills are 10-in. 15-lb. channels with flanges turned away from the center of the car.

The body bolsters are built of structural steel and weigh 490 lb. apiece. Structural-steel bolsters were used in preference to cast-steel bolsters because more strength was obtained at less cost and weight. The bolster is 6 11/16 in. deep at the center by 10 in. wide and is made of 15/16-in. plates connected by 2-in. x 2-in. x 5/16-in. angles. It is designed to carry a load of 10,000 lb. at each end when supported at the center by the truck center plate. Roller side bearings are used.

The underframe is securely tied by diagonal bracing made of 1½-in. x 5/16-in. bars connected with each other and with the flanges of all sills and crossings by gusset plates. These diagonal members were riveted in place under tension. The use of riveted diagonal members avoided the possibility of loose turnbuckles.

The stress diagram printed on page 650 shows the unit stresses in the members of the underframe. It should be noted that the maximum allowable unit stress in the side girders was less than 13,000 lb. and in the platform substructure was less than 10,000 lb.

PLATFORM FRAMING

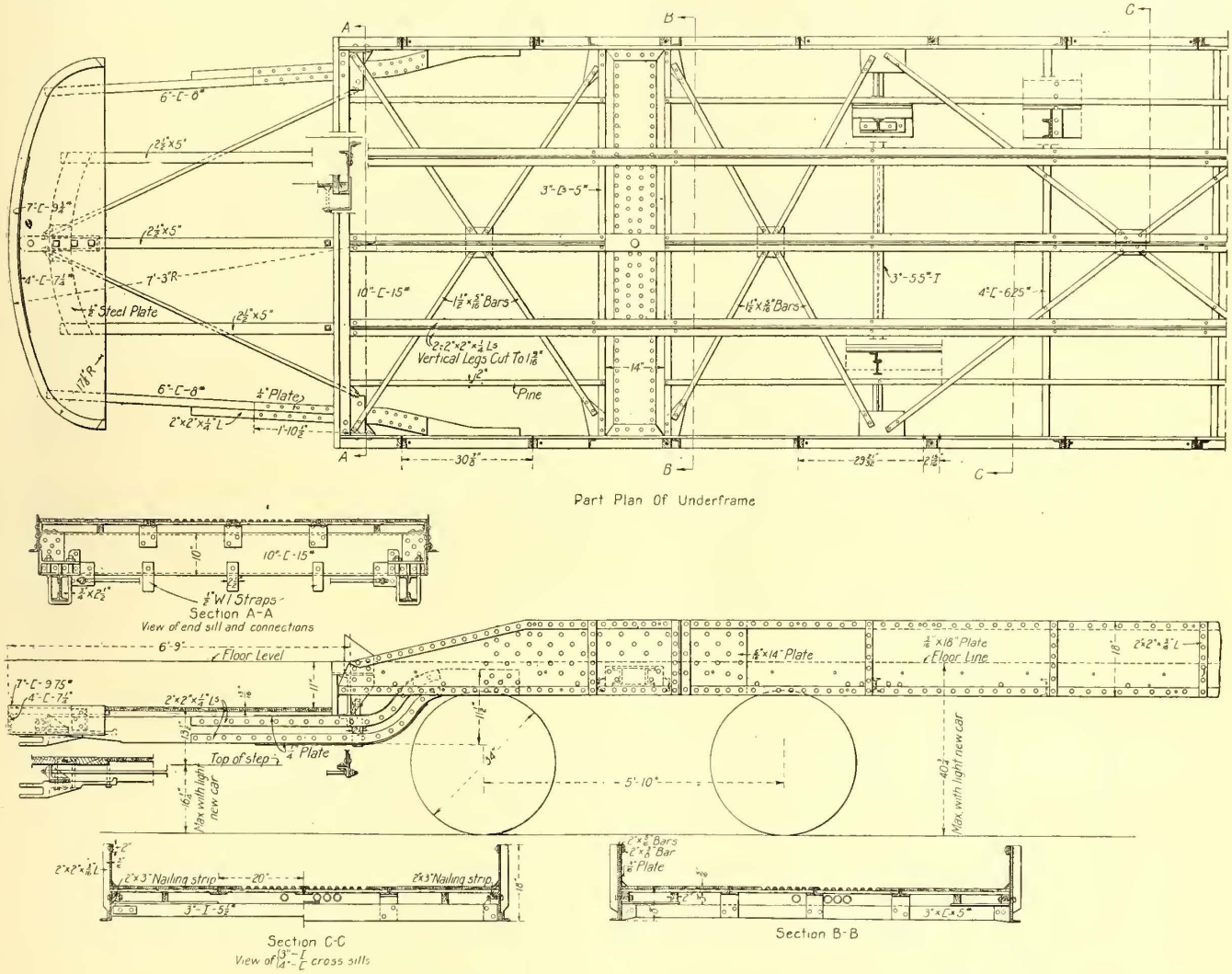
The platform overhang is 12 ft. 3½ in and the platform framing connections were designed to make the platforms, as far as possible, integral with the side frame. The platforms were given an upward camber of 5/8 in. Each platform knee consists of 6-in. 8-lb. channel irons reinforced near the connections by 2-in. x 2-in. x ¼-in. angles and ¼-in. cover plates. The center and two intermediate platform sills are 2¼-in. x 5-in. Norway pine. Each bumper consists of a 7-in. 9¾-lb. channel, reinforced on the inside by a 4-in. channel. The platform framing is tied from the center sill at the drawbar casting to the end sills at the platform knees by two ¾-in. rods.

FLOORING

The design of the floor construction was simplified by omitting the closely spaced small wooden sills used in former cars and replacing them with double-angle floor tees and 2-in. Norway pine floor stiffeners. The floor consists of a bottom layer of 5/8-in. Norway pine laid crosswise and covered with 5/8-in. hollow-back, 3¾-in. face, maple flooring laid lengthwise of the car. Wood flooring was used in preference to composition flooring, reinforced with steel because the wooden construction showed a saving in weight of about 2 lb. per square foot of floor area. The floor strips in the aisle are 5/8-in. x ¾-in. hard maple spaced 5/8 in. apart. The platform floor is 11 in. lower than the car floor and is made of maple fastened with face screws. Safety treads are placed at the doors.

BODY FRAMING

The body side framing is of the concave and convex type. The pier posts are 2½ in. thick and have ⅜-in. steel rods extending through them, tying the metal roof carlines and top plates to the steel angle side sills. The intermediate posts are 2 in. thick and are anchored to the Norway pine subsills by means of hook bolts. The Chicago Railways Company has had considerable experience with sheet-steel panels, but in these cars is using wood. The outer concave and convex side panels are yellow poplar 9/16 in. thick.



Chicago Car—Part Plan, Side Elevations and Sections of Underframing

ROOF FRAMING

The body has a plain arch roof substantially built. The roof has an outside center radius of 8 ft. 8 in. Pressed steel carlines were designed and made for this type of car. These carlines are complete in one piece and are made of No. 16 sheet steel. They weigh 7½ lb. each and have a depth at the center line of the car of 6⅛ in. The flanges pressed on the edges of the carlines are 1 in. wide. A nailing strip is attached to the outer edge of each carline and four openings are provided through the webs. These openings connect the intermediate spaces between the ceiling

and the roof and form the exhaust chamber of the vacuum ventilating system.

The metal carlines are placed over the posts on 30-in. centers. Two intermediate carlines of wood are placed between each pair of pressed-steel carlines. The roof sur-

Chicago Car—Interior View

face is made up of 2½-in. x ⅜-in. poplar sheathing covered with National prepared roofing applied canvas in one piece without longitudinal seams. This canvas was pre-stretched and is mildew-proof. V-shaped copper gutters are attached to the roof above all door openings. The trolley boards rest on ash saddles cut to the shape of the roof and secured over ⅛-in. rubber cushions.

Round-end vestibules of wall construction similar to the car body are provided. Each vestibule has three end windows, a single exit door on the right-hand side looking forward and a full-width entrance and exit door on the left-hand side. The car roof is continuous over the vestibules. No. 16 U. S. gage steel was used for paneling the vestibules, inside and outside, and all panels are removable. The bumpers are covered with steel. The inside finish rail of the vestibules just below the sash is reinforced with a ⅜-in. x 3½-in. iron bar which provides secure anchorage for the controller, air valve and brake staff. Prepayment fare collection is arranged for by providing two bulkhead doors, and a pipe railing, reversible so that it may serve as a motorman's guard rail at the front end of the car and a division between incoming and outgoing passengers on the rear end. Folding steps of the Chicago Railways Company standard are used. The steps on the opposite sides of the car are connected by bell cranks so that when one step is down the other is up.

DOORS

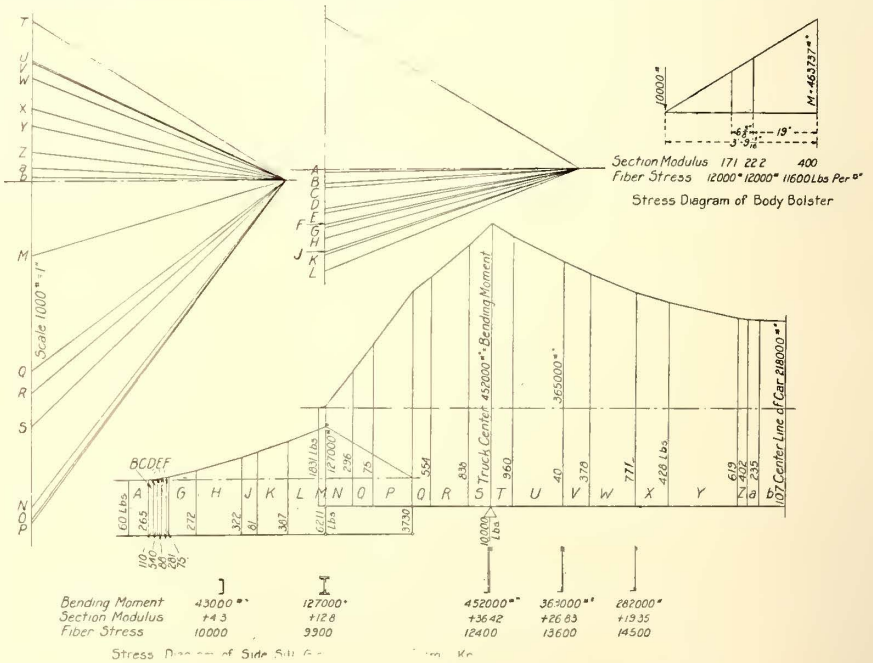
All doors are made of cherry and those at the entrance steps to the platforms have three leaves with a total width of 4 ft. 6 in. The platform exit doors are 2 ft. 3 in. wide and are operated by the railway company's design of mechanism. Each end of the body is fitted with two doors having clear openings of 2 ft. 2¾ in. wide and 6 ft. 6¼ in. high. These doors slide into pockets in the center section of the body end. Earlier types of cars have swing doors, but only sliding doors are to be used in the new cars because of a desire to avoid accidents from broken glass and torn clothing. The sliding doors have ⅛-in. to 3/16-in. play, but when closed are wedged in place by leather cushions which prevent rattling. All doors are 1 in. thick and are hung on Burdette-Rowntree ball-bearing hangers, with statuary bronze housings to match the other car hardware.

BODY DETAILS

Eleven windows are placed on each side of the body and each has two rectangular sashes. The window glass, which is 28 in. x 26 in. and 28 in. x 12 in. in size, is held in Forsyth brass sash frames fitted with Forsyth sash locks and stops. The curtains have Curtain Supply Company's No. 88 ring fixtures with pinch handles instead of friction rollers as used in the other cars. A cherry curtain box, continuous for the full length of the car body, serves as the molding between the car ceiling and side finish. Illuminated sign boxes are built behind each center end window and center side window, conforming in size to the upper sash, which is designed to drop a distance equal to its height. Muslin signs with a black background and white letters are used in these boxes, each sign being stretched on a light wooden frame.

Storm sashes with brass frames are provided for each body window opening for winter use and wire guards are provided for summer use.

A new curtain arrangement has been provided for the two sliding doors at each end of the body. Formerly the curtain was mounted on the center bulkhead, and when it was desired to darken the platform the curtain was buttoned on to the door frame so that it pulled the curtain over the glass as the door closed. Experience has shown that this arrangement is not entirely satisfactory and that the curtain roller spring has a tendency to open the door when assisted by the lurching of the car. In the new arrangement the curtain roller is inserted in a metal box which is mortised into the door and protrudes about ½ in.



Chicago Car—Stress Diagram of Underframing

on one side. The door post is cut away so that the curtain box does not interfere with it. With the curtain box embedded in this position in the door and the curtain edges held in place by brass grooves placed close to the glass, a substantial arrangement is provided, which should fully meet the requirements of operation and not be open to the objections to the old device.

All the inside finish and the doors and window sashes are made of cherry stained to a uniform color and finished dull in imitation of mahogany. The inside finish is fastened with bronze oval-headed screws. The headlining is ¼-in. composite board secured to the ash sub-carlines and stiffened by cherry ceiling bands. This interior lining is brought down the sides of the car to connect with the molding at the curtain boxes just above the windows.

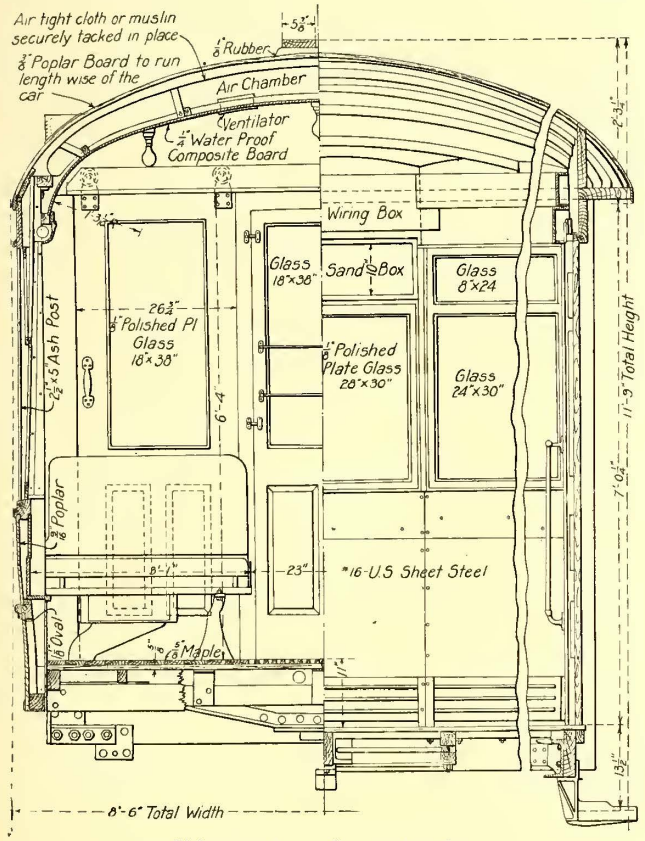
With a view toward improving the appearance of the car interior the unsightly bell cord has been inclosed in a straight run of ¾-in. conduit installed between the ceiling and the roof. The cord pulls directly into the conduit from a pulley at each end and is protected from chafing by bell mouths at the ends of the pipe. The signal bells are inclosed in sheet-steel hoods, which muffle the sound and prevent interference.

HEATING AND VENTILATING

Fourteen cross heaters, four panel heaters and two large platform heaters of the Consolidated type are installed in this car. The platform heaters are secured in an upright position against the end bulkhead directly behind the conductor's position. They are wired in series on the second heating point. The car body heaters are designed not to exceed the following energy consumption at 500 volts:

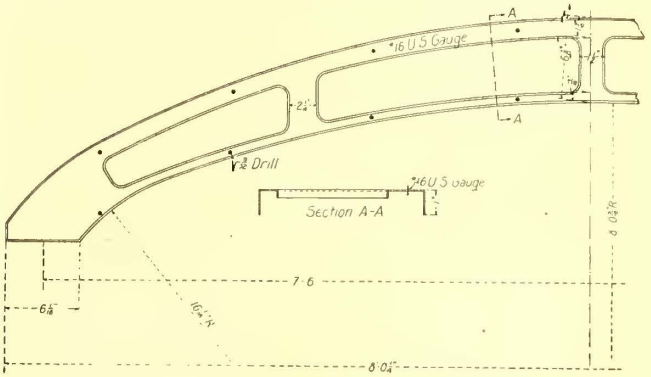
First point of regulation.....	2.666 kw
Second point of regulation.....	4.833 kw
Third point of regulation.....	7.500 kw

The heaters are designed to keep the body heated at a temperature of 50 deg. Fahr. All heater wiring is run in iron-pipe conduit with threaded connections to the heater junction boxes.



Chicago Car—Cross Section

The car is ventilated by the Cooke vacuum ventilating system with fresh-air intakes installed under eight cross-seat heaters. These intake ducts are of pressed steel and admit air through screens in the car floor and discharge it through the electric-heater coils. The vitiated air is discharged from the car body by a motor-driven fan in a sheet-steel fan housing, mounted close to the ceiling above one platform. The air is collected from the interior of the car through fourteen ceiling openings, each 5½ in. in diameter and provided with a shutter so adjusted as to compensate for the decrease in vacuum as the distance from the fan increases. These ceiling openings connect the body of the car with an exhaust chamber formed between the car ceiling and the roof. This chamber is made of air-tight cloth tacked in place and passed through the rectangular apertures in the pressed-steel car lines. The



Chicago Car—Pressed-Steel Car Line

fan discharges the vitiated air outside of the car through two outlets in the platform roof. This method of ventilation is in use on 350 other cars of the Chicago Railways Company.

LIGHTING

Sixteen tantalum lamps are used for the illumination of the car-body interior. Seven lamps are arranged in a line along the ceiling on each side of the car approximately over the center of the cross-seat cushions and two lamps are placed in the center of the ceiling and near the ends of the car. One lamp is placed on each vestibule ceiling about over the conductor's position, one lamp in each headlight and one lamp in each vestibule and side-sign box. Series-burning, 37-watt, 16-cp tantalum lamps are used, as described in this paper for Sept. 23, 1911, page 501. It has been found that sixteen tantalum lamps give considerably better illumination within the body than twenty-one carbon lamps and afford considerable economy in energy and lamp renewals.

SEATS AND FITTINGS

Fourteen Hale & Kilburn walkover cross seats and four longitudinal seats provide seating accommodations for forty passengers. The cross seats are placed 30½ in. between centers and extend 37 in. from the side of the car, providing an aisle 23 in. wide between seat ends. The grab handles and edges of the seats are made of malleable-iron enameled green. The longitudinal seats are 54 in. long and have cherry ends. Sand boxes lined with galvanized iron and fitted with removable top screens and hinged cherry-wood covers are built in the spaces between the corner posts and the ends of the four longitudinal seats. Four handstraps fastened to the ceiling molding by bronze hangers are provided above each longitudinal seat.

The miscellaneous fittings of the new car include bronze push buttons with the Consolidated Car Heating Company's buzzer system, taking energy from the 500-volt circuit; portable seats for motorman and conductor; T-section coupling bar weighing 10.1 lb. per foot and carried on hooks under one side sill; H. B. non-protruding fenders with automatic and foot-actuated trips; truck-wheel guards of the company's standard design; Adams & Westlake pressed-steel headlights with semaphore lenses; Wilson trolley catchers; 12-in. foot gong and pneumatic bell ringer; National air brakes with A-4 compressors; Peacock hand brakes. The body and truck brake rigging is designed so that with 3300-lb. pressure on the cylinder push rod not less than 90 per cent braking power will be provided

WIRING

All electrical wiring beneath the car floor is inclosed in watertight conduit and that above the ceiling in circular loom. Three lines of conduit extend from end to end of the car body just below the floor and close to the center. A wiring box is provided around the vestibule interior just above the window openings, thus furnishing a neat inclosure for the heavy cables from the conduit breaker to the body of the car. The specifications require wires of the following sizes:

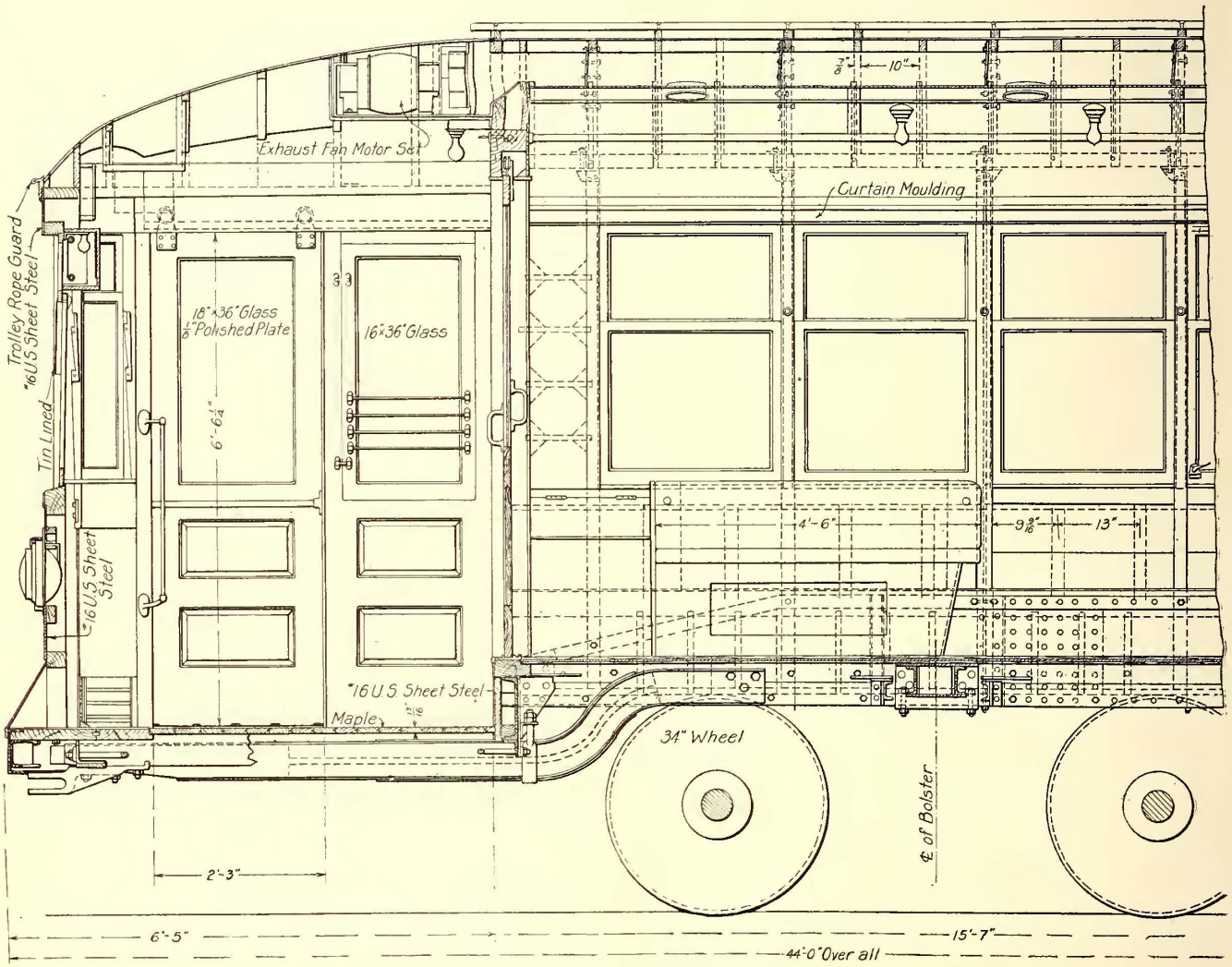
Lighting currents, No. 14, in circular loom.

Push-button circuits, No. 18, in circular loom, except down the side posts.

Fan-motor circuits, No. 14, in circular loom.

Heater circuits, stranded, various sizes, in metal conduit.

Air pump, No. 14 stranded, in metal conduit.



Chicago Car—Part Longitudinal Section

The wiring work and all the electrical apparatus were designed to withstand a test of 1000 volts alternating current for one minute.

PAINTING

The Chicago Railways Company process of painting was followed, the coats being applied to the body exterior in the following order:

(1) Primer.
(2) Putty and one coat of lead.
(3) Two coats surfacer—rubbed.
(4) Two coats olive-green color.
(5) Gold-leaf decorations.
(6) Two coats finishing varnish.

The foregoing process required about twelve days. All cherry on the outside of the car was stained mahogany and given two coats of finishing varnish. The interior woodwork, all of which is cherry, was stained mahogany, then shellacked, then given two coats of interior varnish and rubbed to a dull finish. The ceiling was given two coats of flat color, then decorated, then given two coats of varnish and rubbed. The trucks and all metal parts under the body were given two coats of green paint. The roof canvas was painted before application and then given two coats in place.

TRUCKS

The trucks were designed with a view to low weight as well as riding and service qualities. The type used is the Brill 27 G. E.-1. It has the following characteristics:

Wheel base of truck	4 ft. 10 in.
Gage of track	4 ft. 8½ in.
Length of axles	6 ft. 11¼ in.
Distance from top of rail to bottom of car body bolster, with weight of light car body resting on the truck, with 3½-in. depth allowed for center plates	2 ft. 5¾ in.
Distance from top of rail to top of truck side frame at pedestals, with weight of light car body	2 ft. 4½ in.

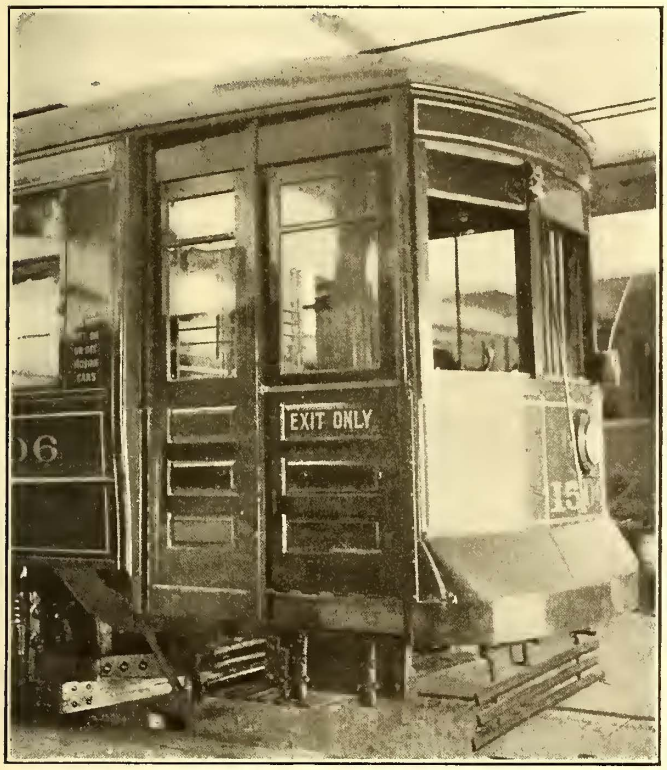
CENTER-PLATE LOADS

Weight of empty car body completely equipped, approximately	11,250 lb.
Weight with seated load of 40 persons in car, approximately	14,250 lb.
Weight with load of 100 persons in car, approximately	18,750 lb.
Weight with maximum load of 110 persons in car, approximately	19,500 lb.
Weight of passengers taken at	150 lb. each

To operate around curves with radius of 35 ft.

These trucks have forged side bars. The transoms consist of 5-in. x 3½-in. x ½-in. angles. The pedestals are fitted with wearing gibs made of 4-in. wide channels. Cast-steel bolsters are used. The following specifications were prepared by the Board of Supervising Engineers for the manufacture of the springs.

"Springs of truck shall be proportioned so that the car will ride easily at all loads, and particular attention shall be given to this subject. Bolster springs to be of the half-



Chicago Car—Exit Door on Front Platform

elliptic type and shall have a length of not less than 36 in. under light car. Coil springs shall be as large in diameter and as long as is consistent with the design of truck, so as to insure easy riding. The springs of the trucks shall be proportioned so that the difference in height from top of rail to top of truck bolster between empty car body and car body with 17,000 lb. live load equally distributed on each center plate does not exceed 2¼ in. Springs of similar type shall show substantially the same deflection under equal loads, the difference in the deflection in no case to exceed ¼ in. Analysis of springs to be in accordance with the following specifications:

SPIRAL SPRINGS

Carbon	0.90 to 1	per cent
Manganese, not above	0.50	per cent
Phosphorus, not above	0.07	per cent
Silicon, not above	0.10	per cent
Sulphur, not above	0.03	per cent

ELLIPTIC SPRINGS

Carbon	0.90 to 1	per cent
Phosphorus, not above	0.05	per cent
Manganese, not above	0.50	per cent
Silicon, not below	0.15 or above 0.30	per cent
Sulphur, not above	0.05	per cent
Copper, not above	0.05	per cent

"Trucks shall be designed to receive outside-hung motors. The motors shall be spring-suspended and the suspensions shall be of the bar type or equal and arranged to receive the General Electric Company's No. 226 motor."

AXLES

An illustration showing the axle dimensions is presented. The journals are 3¾ in. x 7 in., which are the dimensions of the American Electric Railway Engineering Association's standard axle EA, and the journal boxes also conform to association standards. Rolled-steel wheels 34 in. in diameter are used.

Very complete specifications were drawn for the axles, requiring heat treatment of the steel. The size was reduced from 5 in. to 4½ in. in view of the use of special steel and desire to save weight. The requirements for chemical composition of the steel from which the axles were forged were as follows:

Carbon, not over	0.60 per cent
Manganese, not over	0.40 to 0.80 per cent
Phosphorus, not over	0.05 per cent
Sulphur, not over	0.05 per cent

The physical requirements were:

Ultimate strength, not less than	85,000 lb. per sq. in.
Elastic limit, not less than	50,000 lb. per sq. in.
Elongation in 2 in., not less than	22 per cent
Reduction in area, not less than	45 per cent

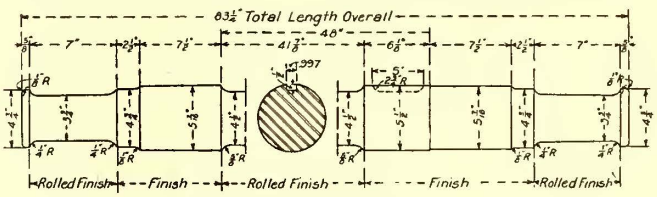
"The elastic limit to be determined by extensometer. Above 40,000 lb. per square inch each increment of load shall be not more than 1000 lb. per square inch.

"A cold-bend test shall be made from the crop end of one axle from each treating-plant heat; if more than one open-hearth heat is represented in a treating-plant heat a test shall be taken from each open-hearth heat represented. The test shall be made with a ½-in. square specimen, not exceeding 6 in. in length, around a mandrel with edges of ½-in. radius, and the specimen shall bend without fracture 180 deg. around said mandrel. Specimen for cold-bend test to be taken parallel to the axis of the axle and on any radius one-half the distance from the center to the circumference."

MOTORS

A new type of interpole box-frame motor was designed especially for this equipment by the General Electric Company. It has K-35 control. The standard motors used on the Chicago Railways have a rating of 40 hp. The new motors are rated at 35 hp at 500 volts and weigh about 440 lb. less per motor than the company's former standard type.

The maximum speed desired with these equipments is 24 m.p.h. on level track at 500 volts potential and the schedule speed is approximately 9 m.p.h. with about seven stops of 6 seconds' duration per mile. The gears were made by the Tool Steel Gear & Pinion Company and have 5½-in. face and eighty-two teeth on three and a half diametrical pitch. The pinions have sixteen teeth. A gear ratio of 17 to 69, with three pitch, is used on this company's 40-hp motors, but a change is contemplated with a view to saving energy. The specifications required that the



Chicago Car—Standard Axle

efficiency of the new 35-hp motors, with gears, be not less than 81.6 per cent with an armature speed not greater than 605 r.p.m. at 500 volts.

The specifications for the new cars and equipment here described were signed by the following members of the Board of Supervising Engineers of Chicago Traction: Bion J. Arnold, chairman and chief engineer; George Weston, representing the city of Chicago, and John Z. Murphy, representing the Chicago Railways Company.

Accident Work of the Future

A Discussion of the Possible Means for Reducing the Number of Accidents

BY F. W. JOHNSON, SUPERINTENDENT BUREAU FOR PREVENTION OF ACCIDENTS PHILADELPHIA RAPID TRANSIT COMPANY

The peculiar temperament of the American people, with its impetuous haste, its reckless disregard of the sacredness of human life and the attendant economic waste in many kindred directions, constitutes a problem of such relatively vast proportions as to challenge the best thought of some of the foremost thinkers of our day. From time to time disasters of far-reaching importance occur throughout the country and momentarily the public is stirred to action. Spasmodic efforts are made to profit by the knowledge gained from these catastrophes so as to prevent their repetition. The effect as a whole, however, appears to be of a more or less temporary character, for the people unfortunately soon turn their thoughts to other matters, only to be shocked at intervals by the recurrence of similar misfortunes. It is indeed singular that such should be the case, yet is the fact one which requires verification?

It is inevitable, then, that eventually there must come a real awakening, when the true significance of the subject will be disclosed and the incentive found for concerted action by the masses for the mutual good of all. Until that time has arrived, however, it clearly is the duty of those to whom is intrusted the safety of others not only to exert every reasonable energy in the direction of safeguarding their welfare but to strive as well constantly to educate the general public so that eventually their earnest co-operation may be brought to bear upon a project so vitally essential to their own good.

As conditions gradually improve, benefits and advantages, both direct and indirect, whose existence has not been anticipated, will accrue to those immediately concerned. There should be a lessening tendency toward the enactment of radical legislation as affecting such matters. The interest of employer in employee will in nowise weaken those harmonious relations so essential to the well-being of each. Vast sums which formerly were devoted to the liquidation of damage claims and kindred expenses will become available for more satisfactory uses. The feeling of additional security to be enjoyed by all is something which will not prove possible of measurement in dollars and cents.

THE POSITION OF THE RAILROADS

While this advancement will eventually become more or less general throughout the entire industrial field, the proposition is essentially one in which the railroads of the country may be expected to take the initiative. With their well-organized systems and daily contact with many millions of people, their opportunities for successful work of this character are unsurpassed by any other line of industry. In like position stand the electric railways, with problems confronting them of an even more complex character.

The larger systems doubtless will organize and equip separate departments whose sole duty it shall be to keep posted upon the latest and most approved methods wherever introduced and to direct and supervise the development of the work upon their own individual lines. Smaller roads situated within a convenient area may find it to their advantage to combine, as it were, and thus to equalize the expense, while at the same time securing all of the benefits enjoyed by the larger companies. Blanks, forms, methods and other incidentals will be standardized and the cost to each thus reduced to a minimum. Various railway associations, may even retain the services of recognized authorities upon the subject, with whom member companies may consult when in need of advice or assistance in meeting troublesome conditions. The establishment of a central bureau representing electric railway interests throughout the country may prove to be an eventuality of the future in accident work.

MEANS AT HAND

I look for an increasing degree of liberality in dealing with employees as a means, incidentally, of arousing interest in the work. In large measure the success of the undertaking will depend primarily upon the existence of a mutual feeling of friendly co-operation between the two. The importance of this cannot be overestimated. Existing problems, which to-day continue to disturb an otherwise tranquil situation, are not impossible of solution if approached in the light of reason and justice.

The adoption of practical safety devices of established merit will receive more serious consideration than can truthfully be said of the present day. Seeming reluctance along this line will give place to a more earnest desire to conserve the element of safety in the ordinary transaction of business. An indication of the trend of events may be observed in the literature issued by a number of the transcontinental systems wherein the attention of travelers is especially directed to the various safeguards with which the operation of trains is protected. In like manner will all places of public amusement and accommodation eventually give prominence to this feature as a medium for attracting patronage. Coincidental with this tendency may we expect the gradual growth of an insistent demand upon the part of the general public that closer supervision shall be expected of those to whom the safety of others is intrusted.

Greater prominence necessarily will be given to the subject in our national conventions as time advances, with the possibility eventually of a separate body being organized, to be composed principally of men actively engaged in furthering the success of this feature of the business. The resultant interchange of ideas and suggestions cannot but prove to be of material assistance and encouragement to those directly interested.

As the scope of the work broadens and the field of its activity becomes more general, the editors of trade journals will find it to their advantage to give proper recognition to the subject through their columns and to lend their aid to its promotion. In time we may look for the appearance in electric railway circles of a periodical to be devoted largely, if not exclusively, to this particular phase of railroading. If rightly conducted, it should prove of absorbing interest to transportation, claim and accident officials, and at the same time a source of much real assistance.

The more general keeping of accurate statistics concerning the various types of accidents, as well as the manner and frequency of their occurrence, will furnish officials with data of a highly important character from which deductions may eventually be drawn of inestimable value. The interchange of this information as between one community and another should still further add to the general fund of knowledge upon the subject.

DISCIPLINE OF EMPLOYEES

The general attitude toward dismissal consequent upon the occurrence of accidents will sooner or later undergo a marked change for the better. The fallacy of the old "hoss car" theory of holding accidents in check through the frequent dismissal of men was supposed to have been exploded many years ago, but the report seems not to have penetrated some communities as yet. In dealing with

conductors and motormen, as with all other classes of men, reasonable allowances must be made for honest mistakes and excusable errors of judgment. We do not always discharge a superintendent, general manager or other official immediately he errs in judgment, even though the lapse oftentimes may chance to be of a rather unfortunate character. More often than not we go over the matter in detail with him and endeavor to guard against its probable repetition by strengthening him. Yet, in dealing with not dissimilar cases among car men we seem disposed to regard a serious error of judgment more in the light of an unpardonable sin.

In many years' intimate contact with car men in the development of accident work it has been my experience to observe that the great majority of serious liability accidents occur as the result of thoughtlessness, forgetfulness, momentary inattention to duty or disturbed mental poise consequent upon worrisome domestic conditions. Deliberate, intentional disobedience of orders without regard to consequences plays a much more insignificant rôle in railroading than the policies of some companies would seem to indicate. It is one thing to endeavor to secure a man's support and co-operation along a given line by holding constantly before him the fear of the loss of his position, and it is quite another thing to seek the same end through the medium of encouragement, education and instruction, together with a proper appreciation of his efforts in your behalf. The one lacks "red blood"; the other inspires confidence and a desire to give satisfaction.

Much has been said in the past concerning the desirability of bringing to the work a higher and more efficient class of labor. The uncertainty of the work, as hereinbefore described, however, has always militated strongly against the accomplishment of this end. Many men, apparently, have come to regard electric railroading as a more or less temporary means of occupation. This, of course, has had its direct effect upon the quality of labor obtainable, as well as the character of service rendered. If the standard of efficiency among the rank and file in railroading is to be raised and an even better element attracted to the calling, the subject under immediate discussion is one, among others, to which careful consideration may well be devoted in its proper sphere.

The application of this to accident work may at first seem somewhat obscure. A moment's reflection, however, will quickly establish the relationship, for in this branch of railroading, even more than in any other, the measure of success possible of attainment will depend primarily upon the intelligence and competency of the operators. Experience is ever an asset. The constant replacement of reasonably competent men with green material, which necessarily will be subjected to identically the same dangers and the same temptations but without the benefit of the experience gained by the former, has always proved a problem of considerable moment in railroading and especially so in accident work.

A more general introduction of the merit system in connection with the tabulation of employees' records will be found desirable. In this way an ideally complete record may be kept of each man, setting forth in minute detail such information as may be deemed of value and affording at the same time an eminently fair and just method by which the competency or incompetency of an employee may be determined with accuracy and dispatch. The system already has reached a high state of perfection upon several important lines and is regarded by them with much favor. Identically the same scheme is applicable to the development of advanced accident work and in time should prove equally valuable.

CO-OPERATION OF ALL DEPARTMENTS REQUIRED

The really ideal combination in accident work requires the mutual support and co-operation of no less than four distinct departments, viz., the operating, claim, legal, and accident departments. In some instances conflicts have arisen as between one department and another, each feeling that the other was attempting to usurp its functions. Such misunderstandings should not be permitted to interfere with the success of the work. A broader view of affairs with the consequent elimination of such trifling issues will permit of a more satisfactory concentration of thought and of energy than has as yet proved practicable in some localities. The interests of the concern as a whole must be recognized as being paramount to those of any individual department.

A continuation of the present thorough methods of inspection of rolling stock and equipment is an additional item of vital concern to the success of our subject. Mishaps caused by mechanical defects or failures are everywhere being reduced to a minimum. They clearly come within the classification of "avoidable accidents," and if a concern is to demand of its employees a high degree of efficiency it is incumbent upon the management to give evidence of its good faith by maintaining the equipment in a satisfactory condition. The old axiom of "penny wise, pound foolish" never had a truer application than it has to the management which pursues a policy of false economy in this direction.

EDUCATION OF THE PUBLIC

Probably the most interesting developments in accident work within the next few years will have to do with the education not only of car men but of the general public as well. The first real test of the successful accident man will be that of his ability to attract and to hold the interest of others in his subject. Originality, resourcefulness, an attractive style and the ability to drive home his argument in a clean-cut, forceful and convincing manner will speedily demonstrate his usefulness as an important adjunct to the electric railroading of the future.

In lieu of something better, many an otherwise successful railroad man of years gone by has taken refuge behind the hackneyed, stereotyped old excuse of "accidents are a part of railroading." We are not prepared to-day to admit the soundness of this argument without certain qualifications. Even if we grant that many mishaps occur which clearly are of an unavoidable character, and that others arise out of circumstances over which we have no control or from conditions which could not ordinarily have been foreseen or anticipated, there still remains a class of accidents for which we ourselves alone stand responsible. Accidents of this latter classification unfortunately are usually of a liability character and constitute, therefore, a somewhat costly feature of the subject. If, however, mishaps of this type are in large measure susceptible of elimination through the application of advanced theories in railroading, it clearly is beside the question for one to put forth so fallacious an argument as the foregoing.

While it is true that the electric railway interests of this country are expending in the aggregate many millions of dollars annually in the investigation, defense and adjustment of accident damage claims, it is a peculiar fact that the immensity of the proposition as a whole does not especially appeal to the average concern, except in so far as its immediate influence may be felt upon its own individual resources or expenditures. Presumably the old adage, "what is everybody's business is nobody's business," still applies. It is not unreasonable to believe, however, that in time this state of inertia will give way to one of greater activity and the problem eventually will be regarded as one not only of local but of nation-wide concern as w

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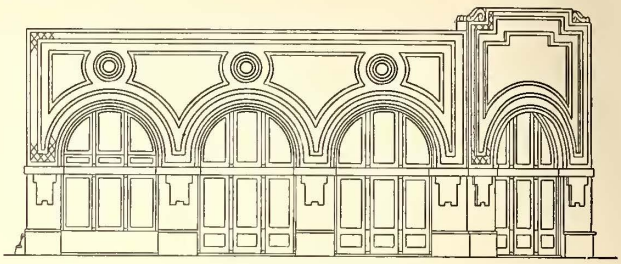
The Allgemeine Oesterreichisch-Ungarische Ga schaft, Austria-Hungary, has purchased the Möd works and has offered to establish a power plan construct an electric railway either direct to Vi Wiener Neudorf to join the Vienna-Baden li

ILLINOIS TRACTION PASSENGER STATION AT ST. LOUIS

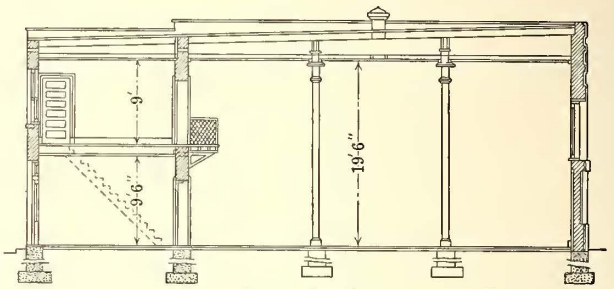
The comprehensive St. Louis terminal project of the Illinois Traction System, which includes the large McKinley Bridge, the two-story Broadway passenger station and the large express station, now used partly for depot purposes, also contemplates the erection of a ten or twelve-story combination passenger station and office building at High Street and Lucas Avenue, St. Louis. At present a temporary station of the design shown in this article is being erected on the terminal passenger station site.

At this location the Illinois Traction system owns a lot 218 ft. long by 143 ft. wide, and the southwest corner is one and one-half blocks north of the Jefferson Hotel. The express station is across the street. The building now under construction will cover a ground space of 100 ft. x 58 ft. and will be of the so-called "World's Fair" type, finished on the outside with a heavy cement coat. Parking space will be provided for three trains, the tracks connecting with the comprehensive yard layout in the neighborhood of the terminal express station.

The new passenger station building will inclose a general waiting room, 40 ft. wide by 100 ft. long, with ceiling 19 ft. 6 in. high. Adjoining this waiting room are two rows of smaller rooms and offices, one row above the other, the offices on the second floor opening onto an iron balcony overlooking the main waiting room. As shown on the general plan the subdivisions on the first floor include a ladies' retiring room, two toilet rooms, a hall leading to the offices on the second floor, lunch stand and kitchen, and a baggage room 14 ft. wide by 50 ft. long. The upper tier



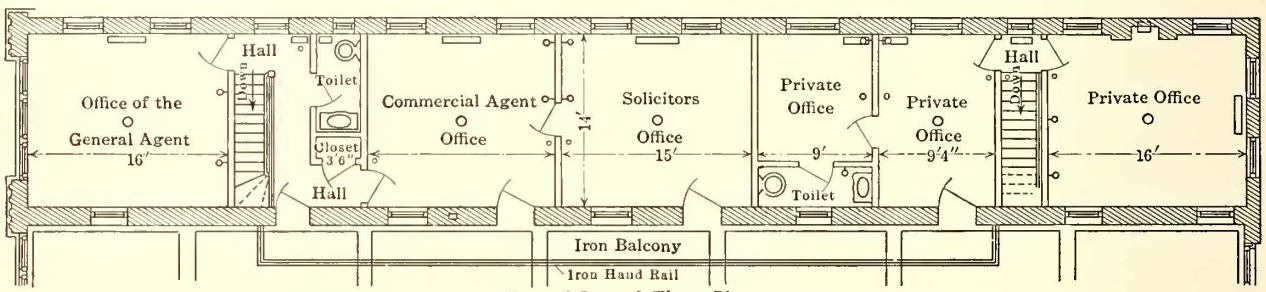
Main Elevation



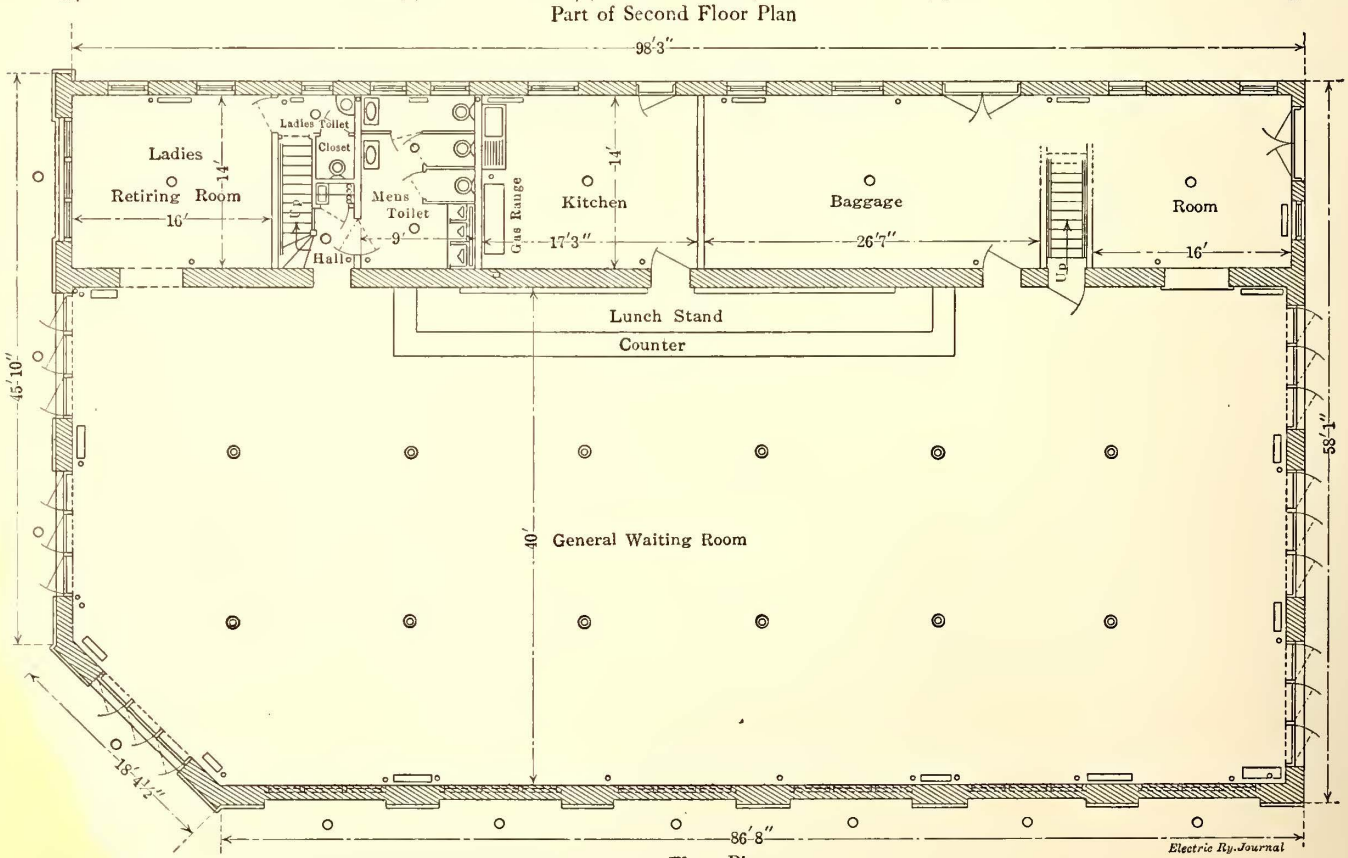
Cross Section

Electric Ry. Journal

St. Louis Terminal—Elevation and Cross Section



Part of Second Floor Plan



Electric Ry. Journal

Floor Plan

St. Louis Terminal—Plan of Ground Floor and Part Plan of Second Floor

of rooms includes offices for the St. Louis general agent, commercial agent, solicitor and three other private offices. The iron balcony for interconnecting these offices permits utilizing the floor space to the fullest extent. All of the offices on both floors have outside windows.

PRIME MOVERS FOR CENTRAL STATIONS

In a paper read before the annual convention of the Association of Iron and Steel Electrical Engineers in New York, Sept. 28, Edwin D. Dreyfus, commercial engineer Westinghouse Machine Company, made some general comparisons of different types of prime movers for power stations. The curves in Fig. 1 were presented by Mr. Dreyfus to show the superior efficiency of the internal combustion engine within certain ranges. The gas engine also remained more uniform in efficiency through various sizes than other types. Oil engines led with an efficiency of 30 per cent to 33 per cent, referred to the shaft horse-power, whereas gas engines ordinarily showed about 23 per cent to 26 per cent heat efficiency on the same basis. Steam piston engines and turbines had a wide range of thermal efficiency from 5 per cent or less to as high as 21 per cent on brake horse-power tests. Both steam and gas engine efficiencies were reckoned on the heat delivered to the throttle valve and included no losses due to boilers or producers.

Ignorance of the fact that the fractional load consumptions of oil engines were in no wise proportionate had led to much misunderstanding of the proper conditions for which such engines were most suitable. It was also necessary to consider decline in efficiency through service. The piston type engine experienced greater losses from wear than turbines. It was true that the plates and walls of turbines might become seriously affected because of the chemical properties of the steam, but in two prominent examples of such erosive and corrosive action the efficiency of the turbine had decreased but 7 per cent to 10 per cent, whereas piston engines might suffer as much as 25 per cent impairment in efficiency.

Referring to Fig. 2, Mr. Dreyfus showed a series of curves on plant instalment costs of normal rated units, including buildings and foundations. He pointed out as a characteristic feature of the gas plant that the unit cost steadily decreased until two or more 2000-kw units are run, whereupon the investment begins to increase directly with the capacity installed. On the other hand, the kilowatt or horse-power cost on the steam turbine station constantly diminishes with increase in size. Therefore the ratio cost of steam and gas stations must constantly grow in favor of the former. This meant that the gas engine would find but limited application in the large station except where the fuel existed in a gaseous state as a by-product or until such time as coal had materially increased in price. Widely fluctuating loads were a hardship to the gas engine because the engine must be operated at a low loading, due to its limited overload capacity. The steam turbine, however, developed generous overloads and therefore could be operated at an economical rating. If the load was characterized by peaks the conditions would be still more unfavorable to the gas engine, thereby raising the ratio of cost of steam and gas prime movers over that shown in Fig. 2.

A study of the relationship of gas, steam and oil power developed the fact that a change in basic fuel conditions might easily turn the tide in favor of one type or the other. Labor was also an element to be considered. In a steam plant the wages varied from 13 per cent to 19 per cent of the total power plant charges and in a gas-producing plant from 20 per cent to 23 per cent when considering the charge at 50 per cent plant load factor with fuel at $2.50 per ton. Under the same conditions non-producer gas plants and oil engine installations paid for labor about 13 per cent to 20 per cent of the total expense. In general the labor cost in the producer plant is one and one-half times to two times that of a steam plant, depending upon the size and number of units installed. Where producers are not required the labor is practically equal and in small one-unit plants may

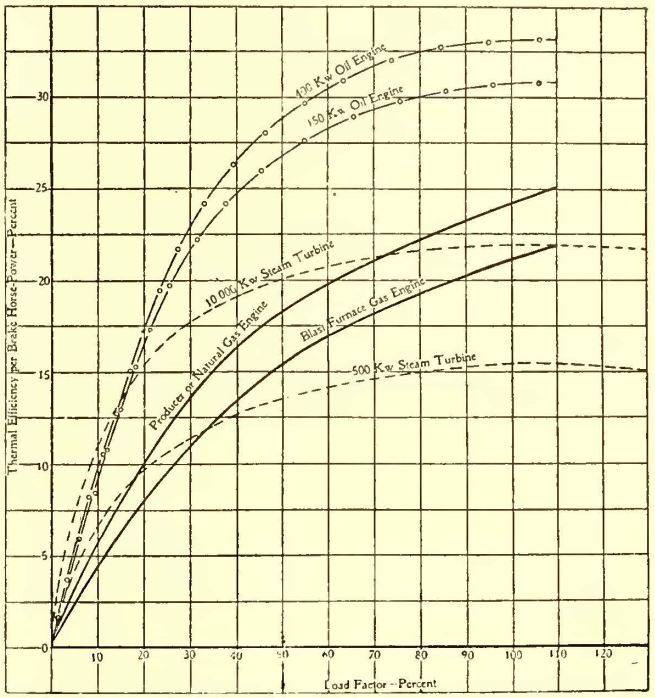


Fig. 1—Ordinary Thermal Efficiencies of Main Units Based on Total Heat Value per Brake Horse-power, with No Allowance for Auxiliaries

be less. Owing to their complexity and greater wear and readjustment gas and oil engine plants require a larger labor force than turbine installations. For these reasons the salaries of the chief engineer and his assistants should also be slightly higher, but otherwise the rate of pay should be regardless of the type of prime mover. A fair average cost of oil, waste and miscellaneous supplies was 20 per

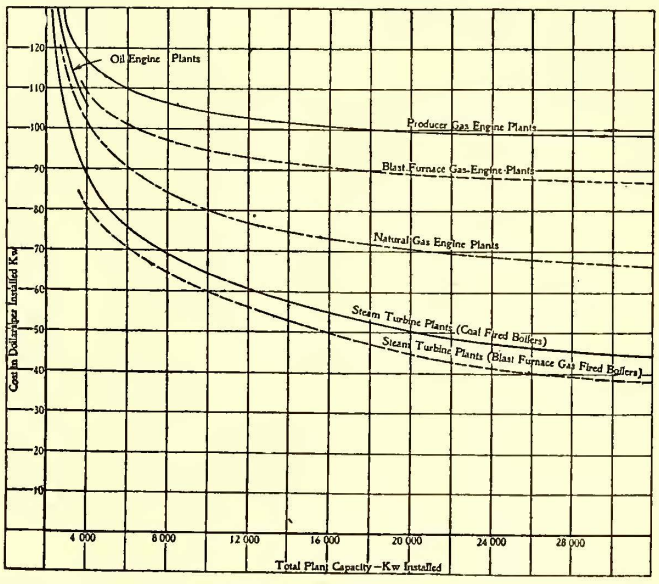


Fig. 2—Plant Instalment Costs of Normal Rated Units, Including Buildings and Foundations

cent of the labor charge. The maintenance charges from a series of analyses of actual repairs seemed to justify the following arbitrary rates: Turbine systems, 1.75 per cent at 100 per cent load factor to 1.37 per cent at 25 per cent load factor of the original cost of the plant; gas and

oil engine systems, 2.25 per cent at 100 per cent load factor to 1.8 per cent at 25 per cent load factor of the original cost of the plant. Since the initial cost of the gas engine was more than that of the turbine, the repair and maintenance charges would evidently be much greater for the gas engine than these percentages indicated.

The author concluded that in small capacities, with high coal cost and no other requirement than power, the gas engine should ordinarily prevail, the oil engine sharing where the price of oil might introduce its competition. Large stations should contain steam equipment unless exceptional conditions favored internal combustion machines.

CAR METER EXPERIMENTS IN ENGLAND

At the tenth annual conference of the Municipal Tramways Association, held in Glasgow Sept. 27 to 29, inclusive, R. G. Cunliffe, technical assistant, and J. G. Cunliffe, assistant electrical engineer, Manchester Corporation Tramways, read a paper entitled "Tramcar Meters." The authors treated the question from two standpoints; first, economical life of equipment as determined by increasing energy requirements rather than by the extent of the wear and, second, means of measuring the comparative care and skill exercised by the motorman in saving electrical energy. The authors made experiments with watt-hour meters, ampere-hour meters and time meters. As an auxiliary meter they also developed a volt-hour meter, the reading of which when divided by the time gave the average value of the fluctuating voltage along a given route. All meters were carefully calibrated, in addition to which graphical recording and measuring instruments of many kinds were employed for checking purposes under actual operating conditions.

THE AMPERE-HOUR METER

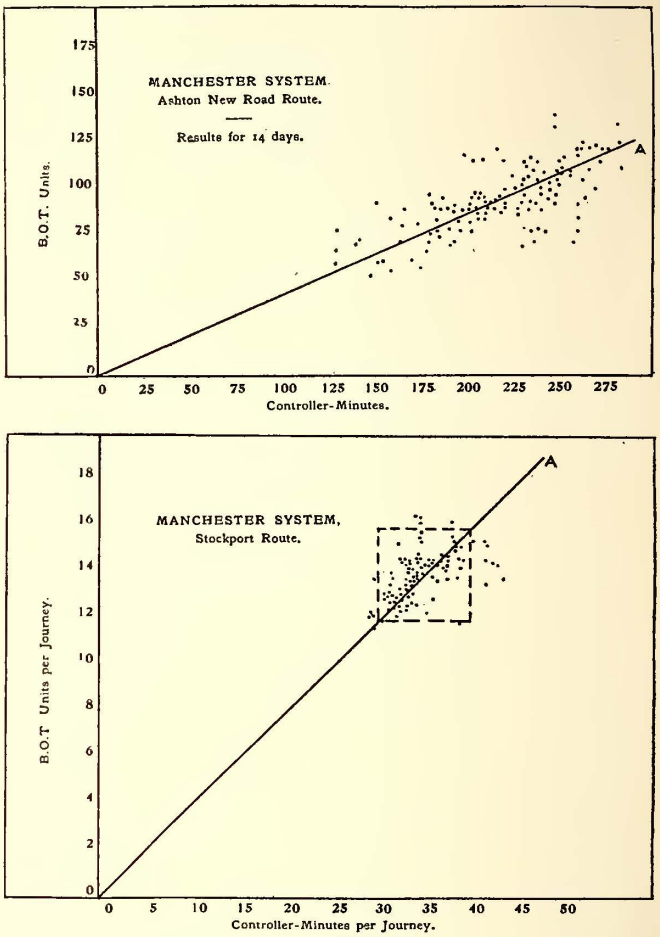
The average voltage on a route as determined by the volt-hour meter was found to be practically independent of the car on which the volt-hour meter was installed, so that a single instrument of this kind would give the true average voltage for a route. Ampere-hour meters on the same route failed to register the consumed energy by the same percentage throughout. Hence uncorrected ampere-hour meters could be employed to place motormen in their correct order of merit as regards consumption of energy, although they could not be used to determine accurately the percentage difference between the values of the various men or cars. The readings of the ampere-hour meters when corrected for the true average voltage gave the actual energy consumption. This correction needed to be applied only to average daily, weekly or monthly values for separate cars or for an entire route as desired in order to estimate the value of the line losses by comparison with the meters or to compare the consumption of cars on different routes.

THE WATT-HOUR METER

There was no direct method of checking the accuracy of the watt-hour meter under service conditions, but numerous readings were taken of watt-hour meters operating in series with ampere-hour meters and checked by volt-hour meters. Under these conditions it was found that watt-hour meters did not work very accurately on a line with wide voltage variation. The difference between the uncorrected ampere-hour meter reading and the watt-hour meter readings was found to be within the limits of permissible error of the instruments due to the difference between the average line pressure and the 500 volts for which the ampere-hour meters were calibrated. In Manchester, however, the differences between the average voltage and 500 volts were so small that it was found desirable to repeat the investigation on lines in Salford, where a voltage variation of some 30 per cent or more was available. It was found that the watt-hour meter appeared to read high at the lower voltages, the error exceeding 10 per cent on a 35 per cent voltage variation. Laboratory experiments showed that the variations exceeded 6 per cent and, of course, would be greater under conditions where fluctuations of current and voltage were simultaneous and rapid. It was evident, then, that if these results were typical of the watt-hour meter, it failed under the very conditions which would render its use desirable.

TIME METERS COMPARED WITH ENERGY METERS

If the time meter was to be of any use as a means of obtaining absolute values, that is, as an energy meter, there



Figs. 1 and 2—Car Meter Tests—Relation Between B.O.T. Units, or Kw-hours, and Controller Minutes

must be a direct proportionality between its readings and the energy consumption. Even if it was to be used only to compare motormen or cars, there must still be some relationship, although not necessarily a direct one. To investigate this relationship entire routes were equipped with both energy meters and time meters. The analyses of daily averages proved not only that the time meter could not be made to give absolute values, but, further, that it could not have been employed with fairness to the men as a means of comparison, although the general tendency of a reduction in controller time was to save energy.

Figs 1 and 2 show typical comparisons taken from practice. In commenting on these the authors said it would be apparent that if the meter in itself was to be of any value the points for individual motormen ought to lie on or be reasonably close to a straight line, such as *O A* or some other line either straight or of a continuous curvature. The fact that they do not do so proved that there was no relationship between energy consumption and controller time. This was further shown by a table giving the order of merit as determined separately from the energy meter and time meter records. In most cases there were wide variations in the two orders. Thus, the first man under energy meters was the fifth under time meters, the tenth

was the fifteenth, the fifteenth was the twenty-ninth, the twentieth was the twenty-fourth, the twenty-fifth was the twenty-second, etc.

The general tendency of a reduction in controller time to reduce energy consumption was apparent from the tests, but the energy saving was very indefinite and actual harm, it was thought, might be caused if the process was carried too far. Car meters were generally supposed to effect a saving in energy by promoting careful and skilful handling of the controller. They tended to prevent waste of energy through running with the brakes on, running on the resistance notches, approaching stops too rapidly with consequent loss in braking, etc. Without meters the motorman might like to have his brake so tight that he would only have to switch off the controller in order to stop his car. With meters, however, the motorman would complain if the brakes were set too tight and would watch jealously the state of the equipments on each car assigned to him. This attention expressed the meaning about the "moral effect" of meters. Nevertheless no amount of coercion, whether by meters or otherwise, could make a man

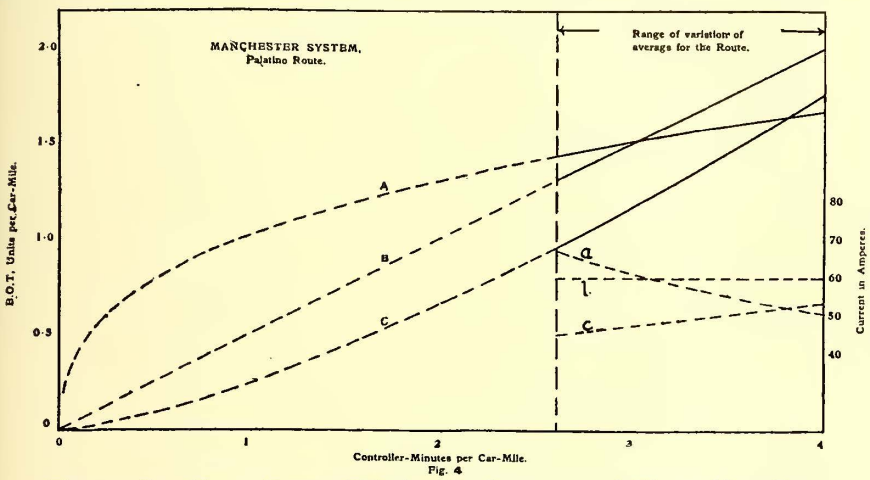


Fig. 3—Car Meter Tests—Relative Performance of Three Men Over Same Route and with Similar Cars

operate skilfully if he did not know how to do so. If the full measure of economy was to be obtained better methods of instructing the motormen in the use of the controller were necessary.

Numerous experiments were made in Manchester to determine the various effects of controller operation. Although the knowledge gained was by no means complete, many interesting results were obtained. Whole routes were equipped with both an energy and a time meter on each car and separate daily records were kept for every man and car. In one case each of the twenty cars on a certain route was operated by the same two men working alternate weeks on early and late finish duty. These tests confirmed the previous observation that there was no definite relationship between energy consumption and controller time, as various motormen obtained the same kw-hours per car mile with very different controller minutes per car mile. This is shown on the curves *A B* and *C* in Fig. 3, which were platted from results given by three men on the same route with cars exactly alike. The working range was from 2.6 to 4 controller-minutes per mile, as indicated. It was evident that with the same value of energy consumption these three men would have very different meter readings. Thus, at 1.6 kw-hours per car mile, which was about the average monthly value for this route, the controller-minutes per car mile would be 3.2, 3.5 and 3.74 respectively. This variety of possible curves was the real reason why the time meter did not classify either men or cars according to their energy consumption. There was a different curve for every man according to his method of operation.

SAVINGS FROM METERS

With regard to the savings obtained from the use of meters, the authors found that under the favorable conditions existing on the Bury system a reduction of 21.79 per cent was made in energy consumption, corresponding to a saving of £41.6 per annum. It was quite out of the question to expect such results on a large city system owing to the complications of traffic and equipment. Although comparatively little could be done in car operation, there was no reason why the full saving resulting from the use of efficient equipment should not be realized.

Companies that used meters ought to exert a continual pressure on the men, as otherwise they would slip back into the old values. In Manchester it had been found profitable to fix a limiting value better than that obtained by the best motorman for each route and to encourage the men to aim at reaching that value.

CONCLUSIONS

The authors reached the following conclusions:

The ampere-hour meter can, with proper supervision, be made to operate with an accuracy of within 1 per cent. Its uncorrected values may be employed to place motormen and cars in their correct order of merit. Furthermore, when corrected for variation of average voltage by the volt-hour meter, it gives the true energy consumption. If percentage differences between the results of various men are required the corrected values must be used.

The watt-hour meter owing to its delicacy, greater complexity and greater inaccuracy is not so desirable or valuable an instrument as the corrected ampere-hour meter.

The time meter, although very accurate in its measurement of time, cannot be trusted to measure the relative consumption of energy within 10 per cent. If used at all, it should be employed only in conjunction with the energy meter for purposes of investigation, in which connection it is very valuable.

The volt-hour meter is indispensable for many purposes and ought to be employed by electric railways to measure average voltages.

On small systems with light traffic approximately equal savings may be effected in car operation and in the detection of faulty equipments, but as the traffic congestion increases the state of the equipment becomes of increasing importance.

NORWEGIAN ELECTRIFICATION STUDIES

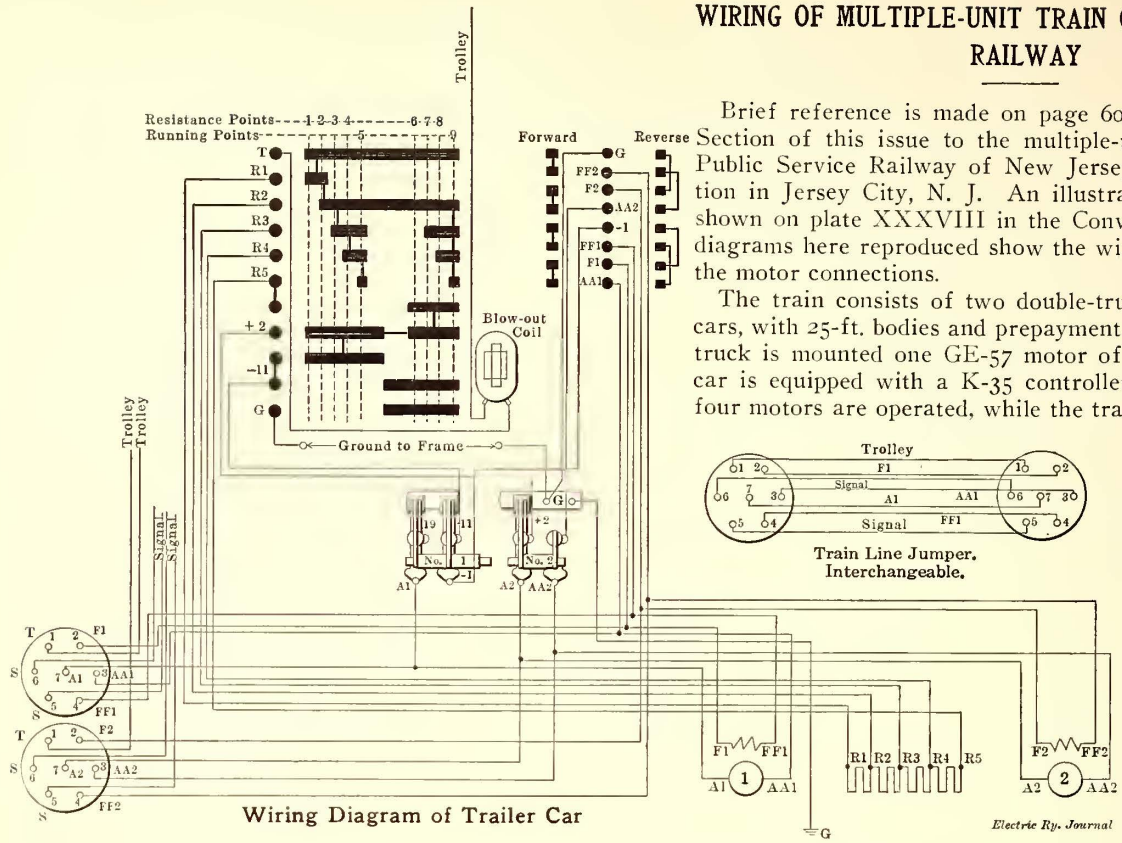
A committee appointed to look into the question of the electrification of Norwegian railways has handed in a preliminary report which strongly recommends a thorough technical study of the situation. In spite of spirited railway building in recent years, Norway's railway system is far from complete. The electric system could therefore be tried on new lines without considering the expense of replacing earlier steam equipment. The unsatisfactory traffic returns of Norwegian railroads in general make it desirable to have some cheap form of motive power, a possibility which is offered by the numerous waterfalls in Norway. The State railways have prepared some provisional plans for the electrification of a number of new and old railways, including the Christiania-Drammen Railway. Norway now has privately owned electric railway systems as follows: Hafslund-Sunnesund (transport), Christiania-Hohnkollen, Thamshavn-Lokken, Notodden-Tinoset and Rollag-Staalheim. The two last-named lines are still under construction.

WIRING OF MULTIPLE-UNIT TRAIN OF PUBLIC SERVICE RAILWAY

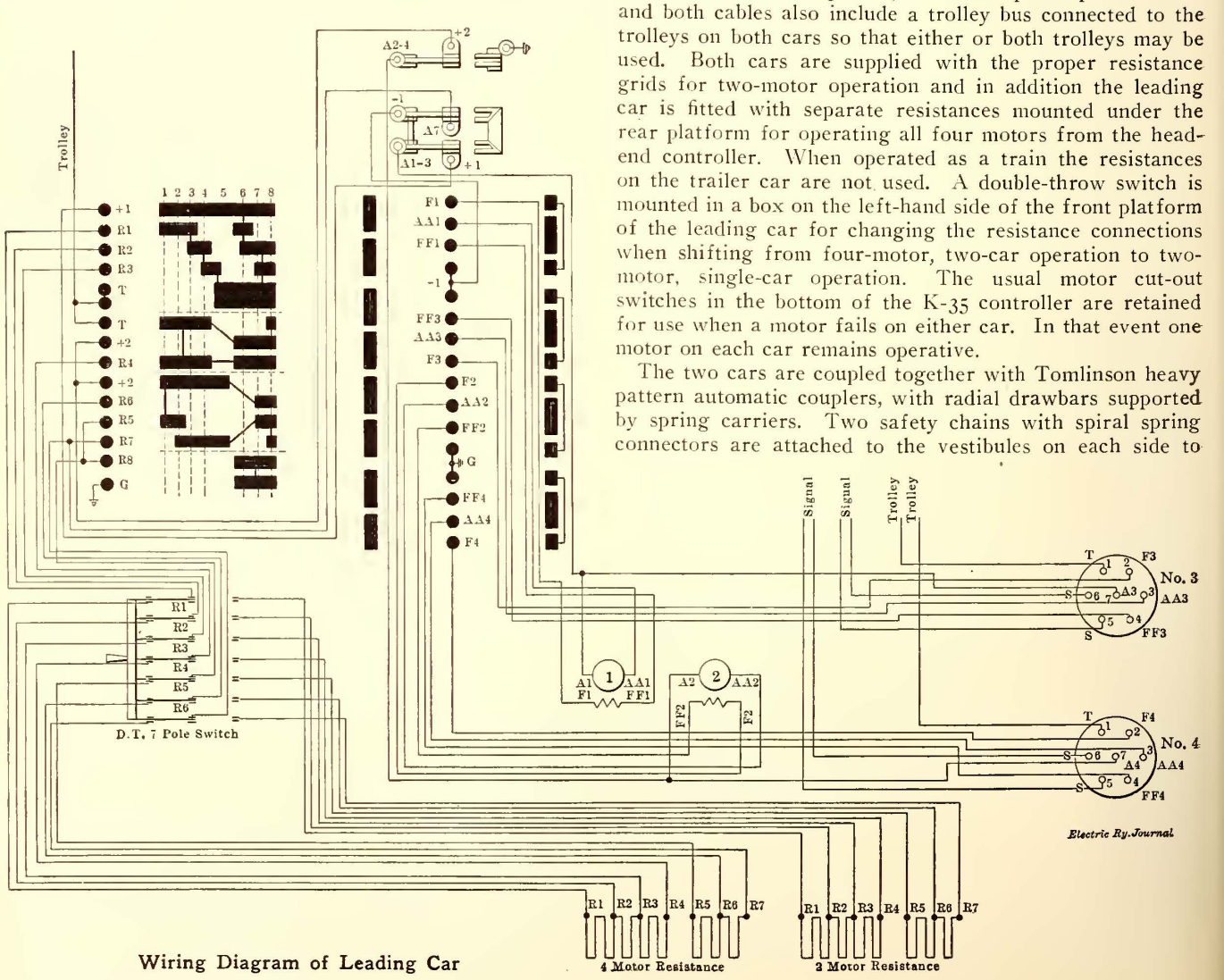
Brief reference is made on page 607 of the Convention Section of this issue to the multiple-unit train which the Public Service Railway of New Jersey now has in operation in Jersey City, N. J. An illustration of this train is shown on plate XXXVIII in the Convention Section. The diagrams here reproduced show the wiring of the train and the motor connections.

The train consists of two double-truck closed single-end cars, with 25-ft. bodies and prepayment platforms. On each truck is mounted one GE-57 motor of 50 hp. The leading car is equipped with a K-35 controller, through which all four motors are operated, while the trailer car is fitted with a K-11 controller on the front platform, through which the two motors under the trailer may be operated when the trailer is detached and run as an individual unit. The four motors are connected up with Nos. 1 and 2 under the leading car and Nos. 3 and 4 under the trailer. The leads to motors Nos. 3 and 4 are made up in separate cables and both cables also include a trolley bus connected to the trolleys on both cars so that either or both trolleys may be used. Both cars are supplied with the proper resistance grids for two-motor operation and in addition the leading car is fitted with separate resistances mounted under the rear platform for operating all four motors from the head-end controller. When operated as a train the resistances on the trailer car are not used. A double-throw switch is mounted in a box on the left-hand side of the front platform of the leading car for changing the resistance connections when shifting from four-motor, two-car operation to two-motor, single-car operation. The usual motor cut-out switches in the bottom of the K-35 controller are retained for use when a motor fails on either car. In that event one motor on each car remains operative.

The two cars are coupled together with Tomlinson heavy pattern automatic couplers, with radial drawbars supported by spring carriers. Two safety chains with spiral spring connectors are attached to the vestibules on each side to



Wiring Diagram of Trailer Car



Wiring Diagram of Leading Car

prevent persons from stepping in between the cars. The coupler heads are fitted with automatic air-hose connectors for the brake-pipe connections between the cars. The brake equipment consists of a General Electric type CP-27 compressor on the head car and straight-air brakes with quick-action valves. A hand-brake wheel is provided on the rear platform of the trailer car for use by the conductor in case of break-in-twos or other emergencies.

The entrance and exit of the trailer car are at the rear platform only. The front platform is fitted with a single seat cushion on top of the sand box on the left-hand side and a movable double seat against the exit door on the right-hand side. The front exit door is locked and the step is covered with a shield when the car is operated as a trailer. In addition to the bell signal the rear car is provided with a switch on the rear platform which sounds a buzzer on the rear platform of the head car, and a similar switch on the rear platform of the head car can be used to sound a buzzer on the rear platform of the trailer car.

POLICY OF ENGLISH MUNICIPAL TRAMWAYS RESPECTING RENEWALS

A paper on "Tramways Finances and Policy" was read at the annual conference of the Municipal Tramways Association, Glasgow, Scotland, on Sept. 27 to 29, 1911, by Councilor James H. Rodgers, chairman of the Newcastle Corporation Tramways committee. It is mainly a criticism of many of the municipal tramways for their failure to provide reserve funds for renewals. An abstract of the paper follows:

"There are eighty-eight corporations that own and work their tramways at this time, while there are eighty-eight others that own them; these are often short lengths of line in small urban or rural districts, which are rented or have a working agreement with larger corporations or private companies to work in conjunction with other lines. My remarks will therefore be confined to the eighty-eight that are working their own tramways at present.

"We ought not to be satisfied with the knowledge that thirty of the eighty-eight tramways may be financially sound, while the other fifty-eight are either struggling to make ends meet or are kept going by the assistance of the rates.

"I have frequently been amused at these conferences, and elsewhere, by hearing speakers give figures in bulk to prove that the municipal tramways of this country are a financial success, thus:

Capital expenditure	£49,568,775
Interest and dividends	1,163,946
Repayment of debt and sinking fund	1,111,888
Reserve (including depreciation and renewal fund)	761,646
Relief of rates	346,274
Aid from rates	64,215

"These are the figures published in November last by order of the House of Commons, and are, no doubt, very interesting; but I have seen them quoted to show the success of municipal tramways, and I have seen them given also to prove how rankly bad they are. To lump figures together in this way, and use them to prove success or otherwise, is simple folly, unless all the municipal tramways were run by a large trust or company and the successful made good the losses of the less fortunate.

"The only correct way to my mind is to take separately the financial position of each.

"The first consideration of a tramways committee ought to be to make the undertaking financially sound by the building up of a sufficient reserve and renewal fund; the second consideration, to see that the traveling public is supplied with proper accommodation and facilities; the third, to see that good conditions of labor are given to all their workers; and the fourth, to see that when the first three are complied with the ratepayers who backed the bill and over whose streets the cars are run should have some return in the shape of contributions toward the rates.

"The financial safety seems frequently to be the last consideration, and not the first.

"No fewer than twenty-six of our municipal tramways undertakings are without any reserve or renewal fund at all, while many of the others are far from satisfactory in that respect. In coming to this opinion I have not set up a high standard and then judged them by it; I have really taken a very low estimate of what in my opinion the reserve and renewal fund ought to be.

"By some committees provision is made in the reserve fund for the depreciation of everything—track, car sheds, rolling stock, machinery and overhead equipment; while in others, and I believe this applies to the most of places, car sheds, rolling stock, machinery and overhead equipment are kept up out of revenue, and provision is only attempted to be made in the reserve fund for track renewals. It is from the latter basis that I propose to judge the financial position of our municipal tramways.

"The loans for rolling stock are generally for fifteen years, and I consider that, with care, the life of the cars can easily be extended over that period, and the cost of so doing be a correct charge on revenue. After the fifteen years have expired and the original debt is fully discharged, if new cars are required a loan could be got to replace them.

"The same remarks apply to machinery and overhead equipment. The upkeep of these is also in my opinion a proper charge on revenue account until the loan period has expired, and then the committees are free to borrow again if need be.

"The track, however, is in a very different position. The money for its formation is borrowed over thirty and sometimes forty years. While the foundation may last that time, I think everyone will admit the rails won't, and will need renewing long before that period is passed. In towns that are hilly or where a very quick service is given, the wear, I admit, is greater than on the level."

A list is then given of places in which expenditures out of renewals and reserve funds have been made for renewals. This is followed by a list of twenty-six places that have no reserve fund whatever. The paper then continues:

"I certainly think these places would have been well advised if they had built up their reserve funds, even though it had required a rate to do so. It would have divided the cost over some years instead of, perhaps, causing a large rate later on, leading the ratepayers of the future to make good this shortage.

"I expect it will be suggested by some that when the time does come they can borrow again to relay the track, seeing that a certain amount of the original cost will have been paid off. If you cannot have a satisfactory margin of profit now, how are you going to get it when you increase still further your expenditure on interest and redemption of a new loan? I consider that at the very least provision ought to be made to defray this cost. It is satisfactory to see that about sixty-seven of the committees are attempting to do so.

LIFE OF RAILS

"We ought, I suggest, to take a life of fifteen years for the rails. It may be quite true that on some routes a year or two longer might be possible, but on other routes the rails may have to be relaid two or three times in that period.

"Many present will have had an experience similar to that of my own committee in Newcastle-upon-Tyne, where the rails in some parts of the city are lasting fairly well, while others, I am sorry to say, are not. In fact we are having for the second time to relay some, although we have not yet been running ten years.

COST OF RENEWALS

"It is generally accepted, I believe, that the net cost of relaying will be about £4,000 per single mile of track, but experience shows it is frequently higher. The inland revenue authorities, who are never eager to make allowances, have agreed, I think, to the allowance of £4,400 per single mile of track for this purpose. I have noticed that in several districts where renewals have already taken place the cost is oftener higher than lower. In one town I find, from its published accounts, the cost of relaying a little over six miles was £33,000, which is over £5,000 per mile.

"What I suggest, then, is that £200 per mile of single track ought to be set aside each year, and if that amount was invested at 3½ per cent in fifteen years you would have £3,800 for each mile of track, and thus be able to relay your rails as they were required. I do not think it can be said that I am placing the amount too high; personally, I consider I am keeping the figure very much on the low side.

"It must not be overlooked that all the money would not be invested during the fifteen years. Some of it would be drawn out long before the time had expired to relay those places that had worn out quicker than the others; thus the interest on such money would not be earned. In that case the money would not represent £3,800 per mile, but something less than that amount.

"In suggesting £200 per mile I wish it clearly to be understood that I do not suggest that as the maximum, but as the extreme minimum.

"Many of the committees, I am sorry to say, appear to think a reserve and renewal fund is quite unnecessary; while others seem to think a few thousand pounds is all that is required, and then hand their surplus over to the rates. To give something to the rates no doubt brings them a great deal of *éclat*, but will it be the same when the time comes to relay their rails and they have not the money to do the work? Will they then receive the plaudits and congratulations of the ratepayers, when they have to levy a rate so that the system may be again put into proper working order?"

A list of thirty-four tramways that showed a loss on their operations last year is then given. The paper continues:

"This is an increase of five over the previous year. I greatly fear that the list will be extended considerably unless some of the committees alter the present policy of handing over all, or the greater part, of their surplus to the rates, and of granting further concessions to the public and the workmen; the incomes of the systems will not allow them to do so."

CLASSIFICATION OF PROPERTIES

The paper then gives statistics of the operations of various tramway systems, which are divided by the author into four lists according to the outcome of their operations. The lists show the number of years that the properties have been operated, the miles of track, the surplus required on the basis of £200 per annum per mile of track, the actual surplus realized, the amount handed over in relief of rates, the amount set aside for renewals, the total amount in the reserve and renewal fund, and the total amount expended out of the reserve or renewal fund for all purposes.

List No. 1 shows thirty undertakings which in the opinion of Mr. Rodgers are doing well. In only three of these cases did the committee place less than £200 per mile in the reserve and renewal fund.

List No. 2 gives the names of fourteen tramways, each showing in the opinion of the author fairly good results. In his judgment the committees in charge were not justified, taking into full consideration the low state of the reserve and renewal funds, in paying the amounts which they did toward the rates. Commenting on these lists and several specific instances to which he calls special attention, Mr. Rodgers says: "It is a great mistake to risk the financial safety of such splendid undertakings in that way."

List No. 3 contains names of sixteen tramways, all of which showed a surplus on the operations of the year, but not sufficiently large to allow a provision of £200 per mile of single track for the renewal fund. The author contends that unless that can be done the tramways are not in a sound financial condition.

List No. 4 shows thirty-two tramway undertakings which reported no surplus at all. All but three of these showed a net charge upon the rates. The paper says that this list will receive additions from list No. 3 unless the committees responsible alter their present policy and see that the tramways are placed on a sound financial basis. Continuing, the paper says:

"I think the committees would do well to consider their position and see if the losses are not caused by having reduced their fares too low, and by giving other concessions which the moderate amount of traffic they carry does not warrant them in granting.

"On my fourth list I have placed a column showing the number of times the different places carry their population in the year; it is surprising to find such a small traffic return notwithstanding that many of the places have adopted the half-penny fare stages which are supposed to increase traffic, if not receipts.

"I hope it will not be thought that I am hostile to the municipal trams; I can assure you that I am not. My only desire is to endeavor to obtain a greater interest in the financial position of the several undertakings by the responsible committees, and to prevent, if possible, the municipal trams from becoming a failure and a permanent charge upon the ratepayers, or perhaps handed over to some private company to make a success where municipalization had failed.

"I am a great believer in corporations owning and working their own tramways; but I also believe that when it is done, it ought to be done on purely business lines.

"Any chairman or manager will tell you that at the present time it is almost impossible to do this. You have members of the councils voting away the profits to the relief of the rates, irrespective of any future requirements in the way of renewals.

"There are others who contend that the ratepayers are not entitled to any financial assistance by contributions toward the rates; that any surplus should be used in giving better and cheaper facilities to the car users, and in granting extra good conditions of labor to the employees.

"With this policy I also entirely disagree; the ratepayers, I consider, for several reasons have a right to expect a return sooner or later.

"I believe in giving every facility possible to the public, consistent with the yield of an adequate profit; but I do not see why we should run cars at a loss, or even at a loss of profit, for the sole benefit of the riding public, when frequently one-third or more of those using our cars may be non-residents in our districts.

"Why should we run, say, a five-minute service at a loss, if a ten-minute service could be run for a profit? Or why should we have half-penny fares, when it perhaps takes a penny fare to pay the cost? No business company would do it; then, why should the municipal corporations?

"The policy of some of our committees would really make one believe they cannot appreciate the difference between a city like Glasgow, with its population of over 1,000,000, carried over 200 times every year, and a district with its 30,000 or 40,000 inhabitants, whose population is only carried by the trams forty or fifty times in the year. In Glasgow, or two or three other cities with their densely crowded streets, a half-penny fare may be both useful and successful; but that, I think, cannot be said of thinly populated areas.

"In no fewer than twelve towns where losses are made

each year the committees have granted half-penny fares; while in six others where the profits are not sufficient to make proper provision for track renewals the committees have made the same concession.

"In only ten places that may be looked upon as financially successful are half-penny fares allowed.

"This goes to prove very clearly, I think, that half-penny fares ought not to be given, especially by small tramway systems; even the larger systems should be exceedingly careful before granting such facilities.

"I shall now refer to what I consider another mistaken policy which some of our committees have adopted, viz.: the running of cars at cheap fares each morning. In several towns all passengers are allowed to travel at half the ordinary fare up to 8 and 9 o'clock in the morning, issuing return tickets at the same rate in many places; that, to my mind, is undoubtedly a great mistake and a decided loss to those undertakings.

"Excepting six towns, we all, I believe, run workmen's cars. I wonder how many make them pay; very few, I should think, if any.

"I do not say we ought not to run workmen's cars, but I do contend that we ought to have a return from these cars sufficient at least to pay the cost of working them; they ought not to be a charge upon the undertaking.

RELATIONS WITH EMPLOYEES

"We have had recently several strikes, and others threatened, and a general feeling of unrest has been exhibited by the men.

"Personally I think this unrest arises very largely from a misconception on the part of the men. I rather think they have got the idea which is put forward by some members of the councils and others that they ought to be the first and last consideration of the committees; that the trams are a kind of copartnership arrangement, they being the only partners, and that any surplus ought to be expended in giving them shorter hours and more money; but should any loss occur, the ratepayers can make that good.

"This, to my mind, is altogether wrong. I believe in dealing with the men fairly and even generously. We ought to give them a somewhat higher wage than that paid in the respective districts to men doing the kind of work from which our employees are generally drawn; we ought to grant them reasonable hours of labor, and these ought to be worked in the least possible compass; we ought to do our very best to ease away any irritation that may from time to time arise.

"We have no right to raise those men to a position equal with skilled mechanics, who have had several years to serve to learn their trade.

"A skilled mechanic has frequently to suffer financial loss from slackness of work; all his holidays, compulsory and otherwise, are deducted from his wages, and he must purchase all his own working apparel, while the tramway employee is provided with a full uniform, is allowed holidays each year with full pay, and enjoys regular work, without any lost time, unless it is caused by his own neglect.

"If, then, we compare the average income of the two, it will be found that the wages and emoluments of the tram employees, who are generally drawn from unskilled labor, will equal the net income of the skilled artisan. To place him higher still, either by granting more wages or by reducing his hours of labor, would, in my opinion, be not only an injustice to the trained mechanics, but quite unfair to the undertakings we have to manage and direct.

"I do not suggest that employees on all tramways are quite free from grievances. That would be almost an impossibility, but I do think that any grievances they may have could easily be put right by a conference between the manager and representatives from committee and men.

"It is certainly not for the benefit of either the employees or the general public to make things so difficult that the tramway undertakings cannot be made financially successful by the corporations. If committees are driven into excessive expenditure, and their undertakings become a regular charge upon the ratepayers, we can rest assured that in a very little while the latter will rebel and endeavor to free themselves of the incubus; they will demand that the tramway undertaking shall be handed over to private enterprise to make the best of it, and thus free themselves of the yearly loss."

DISCUSSION AT TACOMA ON MEDICAL TESTIMONY IN ACCIDENTS

The subject of medical expert testimony in accident cases was the topic for discussion at a banquet of the Stone & Webster Club which was held at the Tacoma Hotel, Tacoma, Wash., on Sept. 13. The toastmaster of the evening was E. H. Odell, general claim agent, Puget Sound Electric Railway. The first speaker was Dr. Read, who considered the relations of the courts to the medical expert, the lack of legal control of the medical witness, and finally the duties of the medical witness.

With regard to the relations of courts to the medical expert, he pointed out the deplorable conditions due to having highly technical questions decided by juries and judges, who are laymen, and therefore not competent to distinguish right from wrong in the statements made by conflicting experts. The lack of legal control of the medical witness was largely the fault of the courts and of the absence of a little suitable legislation. As a rule, competent physicians did not differ in cases of injury or disease when they met at the patient's bedside or in consultation. There should be no greater differences of opinion when like matters are brought into litigation. Lawyers always differed and selected the medical expert as the butt of their differences. Opposing counsel rarely interpreted the law alike. Medical experts would become more and more discredited until there was some law which defined their status and the conditions under which they should be allowed in court.

With regard to the duties which a witness owed to the public, he said that he was remiss when he allowed either party in the litigation to use him as a tool for selfish ends. It was the contingent fee that made the doctors and lawyers for the prosecution so positive in their questions and answers.

Conditions would be bettered if cases which involved expert testimony were taken out of the hands of juries. The courts could be assisted in reaching a decision by their own experts who had been selected in competitive examinations. Furthermore, no physician should be permitted to give any testimony except that which related to his personal knowledge of the case nor should he receive more than the customary medical fees for his court services. His testimony should be reviewed by court experts paid out of the public funds.

Reply to Dr. Read was made by Hon. John A. Shackleford, president of and counsel for the Tacoma Railway & Power Company. He did not believe in the abolition of the jury system unless something better could be substituted for it. A new system in which questions of fact would be submitted to judges would, he thought, fail to produce better results, because three or five judges were far more likely to split hairs about technicalities than a dozen plain jurymen. He hoped to see the time when most expert questions would be submitted not to juries or judges, but to special commissions.

Dr. L. L. Love, surgeon for the Tacoma Railway & Power Company, mentioned his court experiences. He always tried, he said, to tell the truth, but it seemed to him that his testimony became of little value as soon as he admitted that he was an employee of the railway company.

Dr. W. C. Cox, surgeon for the Everett Railway, Light & Water Company, agreed with Mr. Shackleford that expert testimony cases ought to go before commissions.

Dr. Park W. Willis, physician and surgeon for the Seattle Electric Company, said that juries should not be allowed to pass upon matters over which experts themselves were in doubt, but nevertheless they could be trusted to decide questions of simple fact even in medical cases. The value of testimony was not necessarily impaired because the physician happened to be an employee of the railway. It depended largely upon his own attitude and personality. He could not be discredited if he never testified to anything that he did not know, no matter how small a detail it seemed.

Frank D. Oakley, trial attorney for the Tacoma Railway & Power Company, said that many misunderstandings in expert testimony cases were due to the excessive and often needless use of technical terms. The Supreme Court of the United States had rules that a federal judge had no authority to appoint a physician to examine the plaintiff, and if he should do so the verdict would be reversed and a new trial granted. In most cases the medical expert who appeared for the plaintiff was one of the ablest men in his profession. The railways who were fighting these cases should also be willing to get men of standing and give them ample compensation.

CONVENTION NOTES

PROGRAM FOR ENTERTAINMENTS

The entertainment committee of the American Electric Railway Manufacturers' Association has announced certain features which have been decided upon in connection with the annual reception. This reception will be on the evening of Monday, Oct. 9, and will be held on the Convention Pier, which is to be the center of all of the events on the entertainment program. The reception will begin at 9 o'clock and the following booths will be reserved for the convenience of the officers and ladies of the various executive committees: American Electric Railway Association and American Electric Railway Manufacturers' Association, booths of the Dearborn Drug & Chemical Company and The J. G. Brill Company; American Electric Railway Engineering Association, booth of the Pennsylvania Steel Company; American Electric Railway Transportation & Traffic Association, booth of William Wharton, Jr., & Company; American Electric Railway Accountants' Association and American Electric Railway Claim Agents' Association, booth of the General Electric Company.

The reception will be preceded by a musical program lasting for about an hour. After the reception there will be informal dancing in the ballroom in which the reception is held on the Convention Pier.

Special attention has been given to this year's concerts. Wassili Leps, conductor of the Philadelphia Symphony Orchestra, will have charge of the music for the entire week. Mr. Leps has achieved marked prominence in Philadelphia among the critics, and his morning and afternoon concerts will undoubtedly be appreciated by the ladies and gentlemen of the various associations. At the concert held in connection with the reception on Monday evening Miss Charlotte Guernsey, operatic soprano of the Philadelphia-Chicago Grand Opera Company, will render a special program and will be accompanied by Mr. Leps' orchestra of thirty pieces. The Leps orchestra will give two other concerts at the Pier on Monday, one at 11:30 a. m. and the other at 3 p. m. Special musical programs in pamphlet form have been prepared showing the entire week's music.

ROLLER CHAIR SERVICE

A special effort has been made this year to have the roller chair service attractive, effective and efficient. The chairs, of course, will be furnished from stations at Convention Pier, at the Marlborough-Blenheim and at the Chalfonte to those wearing the official badge without charge between the hours of 9 a. m. and 7 p. m. In addition, on Monday, Tuesday and Thursday evenings roller chairs will be furnished to convey the delegates to Convention Pier. The chairs are, of course, furnished at appreciable expense for the convenience and pleasure of all members and guests of the different associations, and it is hoped that the members will take throughout the week full advantage of this special privilege.

OBSTACLE GOLF

Another entertainment feature which promises to be popular is the obstacle golf contest, which may be played on the side lawn, Marlborough-Blenheim Hotel, any morning and afternoon. On this lawn is a small nine-hole course with all kinds of fool hazards. A round can be played in twenty minutes. Any person who is mechanically or intellectually inclined, but has no other knowledge of golf, is able to play this game as well as the veteran golfer. Such a course at the Cooperstown convention of the Street Railway Association of the State of New York last June created all kinds of fun and sport.

THE CHICAGO TRAIN

The transportation committee in charge of the special train to Atlantic City from Chicago reported on Monday morning that all reservations had been taken and that fourteen cars would be required to carry those who had applied for accommodation on this train.

ARTIFICIAL LEATHER FOR CAR SEATS

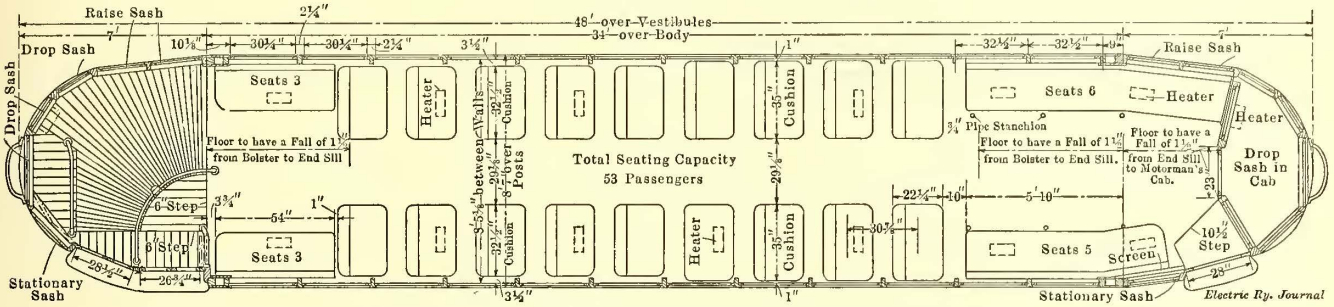
The I. E. du Pont de Nemours Powder Company, Wilmington, Del., is making an improved artificial leather known as Fabrikoid. This material is designed for most of the uses of natural leather as well as for other purposes for which the latter is not adapted. Its principal field in electric railway work, however, is for car seats, for which it appears especially desirable because of its durability and sanitary qualities. It is stated that Fabrikoid is tough, pliable or non-cracking, stain-proof and washable with soap and water. This material is made of any desired color, grain and finish in various convenient widths up to 54 in. in continuous rolls of 30 yd. to 60 yd. with cloth backing. It can be matched with previous installations far more easily than natural hide leather.

A. H. Carlisle, of Carlisle & Company, New York, N. Y., has recently returned from London, England, after organizing the P-A-Y-E (London) Syndicate, Ltd. This syndicate is about to incorporate the International P-A-Y-E Tramcar Company, Ltd., which will own the patents and the license to manufacture prepayment cars in the continent of Europe, including Great Britain and Ireland. The British Electric Traction Company at the present time is placing prepayment cars in operation at Gateshead, England. Negotiations are also under way to introduce prepayment cars in Milan, Italy, and Paris, France. Mr. Carlisle reports great interest in the prepayment car among the electric railway managers on the Continent and in England.

It is stated that the Japanese government has authorized the municipality of Tokio to take over the electric tramways of the city. It is proposed to abolish 13 miles or 14 miles of the existing lines and to construct five new lines, three of which were especially ordered by the government to be completed by July 31, 1916. An endeavor is to be made to finish the lines by the end of 1914. The municipal authorities propose to build about 500 new cars. It is stated that electric lighting will first be transferred to the city, for the Tokio electric tramways have their own electric lighting department, which the city will now have to maintain.

COMPOSITE WOOD AND STEEL CARS FOR KANSAS CITY

The Metropolitan Street Railway Company, Kansas City, Mo., has just received from the Cincinnati Car Company twenty-five cars of the design shown in the accompanying illustrations. These cars are similar to the twenty-five which were built for the same company last year. Their principal features are the straight steel plate sides which form a stiff girder and eliminate both upper and lower trusses; the narrow side wall which is secured by using raise instead of drop sashes; the cross seats, which are bolted directly through the side steel plate; the arch type roof, which is lighter and costs less to maintain than the monitor deck, while giving greater stiffness to the upper part of the car body and permitting more effective ventilation.



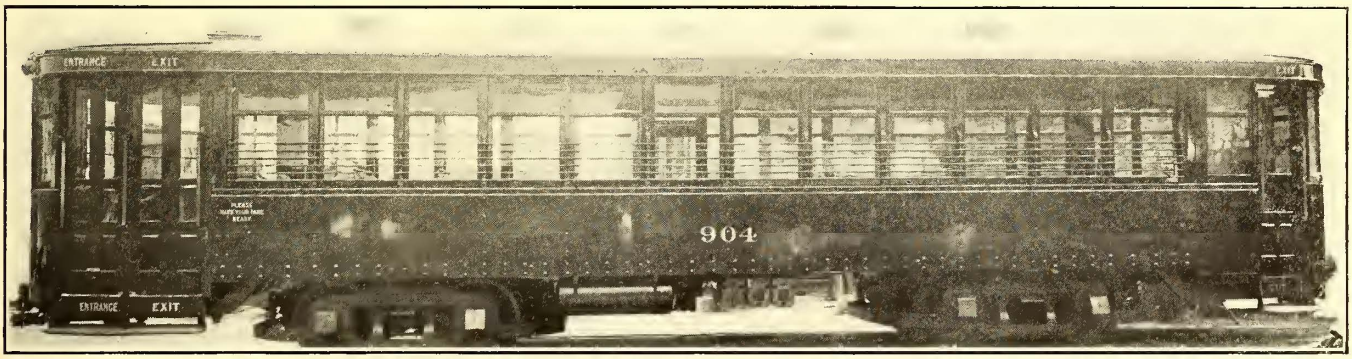
Plan of Kansas City Single-End Prepayment Car, Showing Ramp on the Conductor's Platform

The cars are arranged for single-end prepayment operation with the vestibules at each end inclosed on the devil-strip side. This prepayment method, which was designed by the Metropolitan Street Railway, embodies several interesting features. As indicated on the accompanying plan, the body flooring at both ends of the car has an inclination of 1½ in. from the end sill to the body bolster. The entrance on the rear platform is inclined 12 in. from the floor at the entrance door opening to the end sill, as shown in one of the halftone illustrations and the plan. This ramp is provided with strips of Mason safety tread. This arrangement gives an exceptionally low step from the rail to the step tread. The step opening at the rear vestibule has one set of double folding exit doors and one two-part sliding entrance door, both of which are manually operated by the conductor. Four steps are required from the rear exit of the car body to the pavement. Pipe division rails divide the entrance from the exit and also divide the conductor's stand from the entrance. The conductor's position is at the extreme rear of the platform behind the railing, whence he has a clear view of both passages while always facing passengers inside the car body. He can observe patrons approaching the entrance from the front before giving the signal to start the car.

The motorman's cab partition extends the full width of the front vestibule. It is glazed in the upper portion to give the motorman a clear view in every direction. The single sliding exit door at the right-hand front end is hand-operated by the motorman. A small mirror on the vestibule post on the motorman's right hand enables him to observe the movement of passengers who are leaving via the front exit. As there is no bulkhead at either end of the car, the full opening between the corner posts is obtained.

The principal dimensions of the car are as follows: Length over the corner posts, 34 ft.; length over the bumpers, 48 ft.; length over the rear platform, 7 ft.; length over the front platform, 7 ft.; width over the side posts, 8 ft. 7 in.; height from the bottom of the sill to the top of the roof, 8 ft. 9¾ in.; height from rail to the bottom of the sill, 33¼ in.; truck centers, 21 ft. 10 in.; wheel base of trucks, 4 ft. 10 in.; diameter of the wheels, 34 in.

The underframing is of composite construction, the side sills being formed of yellow pine plated on the outside with 3-16-in. x 32-in. steel plate, both the sill and plate extending the full length of the car body proper. The steel plate forms the side wall of the car body below the windows. The end sills and cross joists are of oak reinforced with steel angles and plates respectively. The platforms are supported on the step side with 7-in. steel channels and on the closed side by 3-16-in. x 42-in. steel plate, which forms the outside sheathing of the vestibule. This steel plate is spliced to the 3-16-in. x 32-in. car body steel plate, thereby dispensing with the usual under platform knee at this point and saving weight. The two center platform knees are of 4-in. x 3-in. x 3-8-in. steel angles spaced to accommodate drawbars.

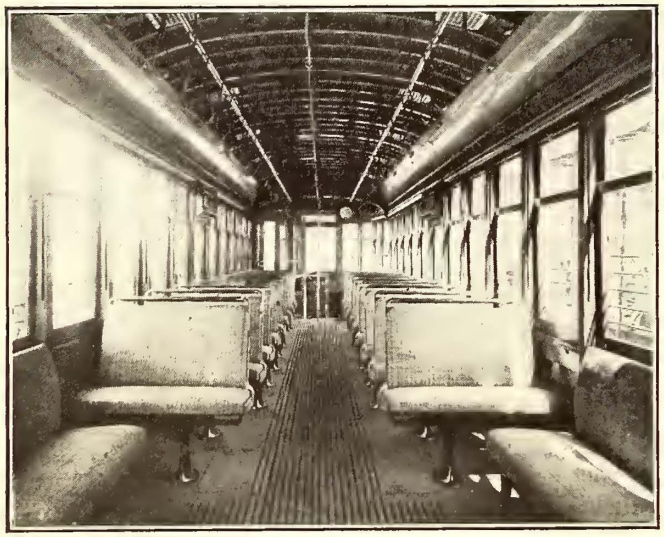


Single-End Prepayment Composite Wood and Steel Car Used in Kansas City, Mo.

There are twelve windows on each side of car, each in two parts; the upper part is stationary and the lower part is arranged to rise straight up behind the letter board. The windows have the Dayton Manufacturing Company's raise sash locks, racks and compression rollers. There are ten ventilators per car mounted on the roof beside the trolley boards. The openings to the interior of the car are equipped with Hart & Cooley pressed metal registers measuring 9 in. x 9 in. The interior view shows eighteen Hale & Kilburn steel cross seats and the longitudinal corner seats. The total seating capacity is 53.

A Willard storage battery is employed for operating signal push buttons and for operating the tail lamps when the trolley current fails. The fare register is installed inside of the rear vestibule over the position of the conductor, who operates it by pedal mechanism.

The cars are mounted on Standard Motor Truck Company's No. O-50 trucks with 34-in. forged steel wheels.



Interior of Kansas City Car, Looking Toward Rear Platform

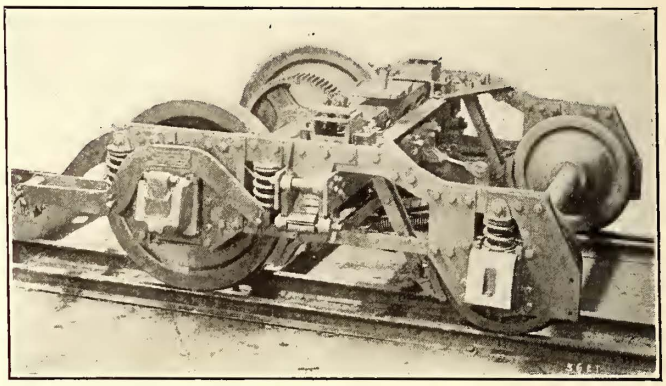
The electrical equipment consists of four Westinghouse No. 306 interpole motors with single-end K-35 control. All the power wiring is run in iron conduit underneath the car floor. The air brakes are of the National Brake & Electric Company's straight-air type. The weight of the car complete ready to run is 48,400 lb., or 913 lb. per seated passenger.

Ramp for Entering Passengers on Rear Platform of Kansas City Car

The special equipment consists of Metropolitan Street Railway standard sanders, radial couplers, corrugated buffers, International fare registers, Consolidated electric heaters, Faraday buzzers, United States No. 1583 headlights, Eclipse fenders, Peacock hand brakes, cast-steel body bolsters and Curtain Supply Company's No. 49 Pantasote curtains.

TWO NEW TYPES OF SINGLE-MOTOR TRUCKS

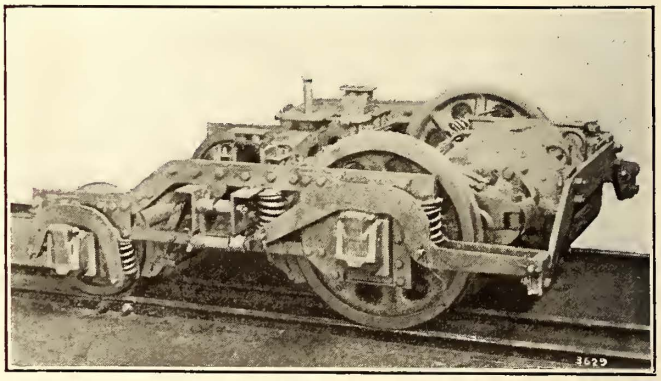
The Baldwin Locomotive Works, Philadelphia, Pa., have recently built for the Philadelphia Rapid Transit Company and the Richmond & Henrico Electric Railway two types of single-motor trucks in which several new features are embodied. The trucks built for the Philadelphia Rapid Transit Company are designated by the builders as class 54-18-M. They have a wheel base of 54 in. and are designed to carry a load of 18,000 lb. on the center plate. Each truck carries a GE-70 motor supported with the Baldwin system of equalizing beams over the journal boxes of the driving axle. The side frames of these trucks are of



Single-Motor Truck for Philadelphia Rapid Transit Company

bar iron, 1½ in. x 4 in. in section and placed vertically to secure maximum strength. The pedestals are of steel plate, fitted with removable malleable iron gibs. The transoms are 3¾-in. x 7-in. channels secured to the side frames by a single gusset plate on each side. This plate is cut out to provide clearance for the bolster and is flanged to form a suitable bolster stop. The bolster is of cast steel, supported at each end by a half-elliptic spring suspended by links.

The pony axle supports one end of the side frames through coiled springs placed over the journal boxes. On the motor end the equalizing beams fulcrum directly on the journal boxes and the motor suspension bar is hung from the outer ends of the beams. The weight is transferred to the truck frames through coiled springs, which are so located that the motor reaction on the frames is always upward and the tilting effect on the frames when the motor is developing torque is reduced to a minimum.



Single-Motor Truck for Richmond & Henrico Electric Railway

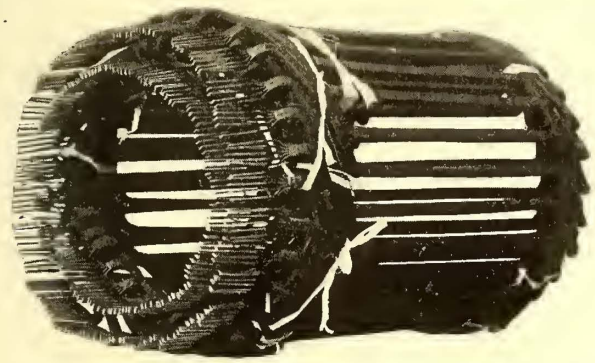
The wheels are of forged and rolled steel, 33 in. and 22 in. in diameter, and the journal boxes are of liberal size, so that sufficient packing can be carried to insure effective lubrication. These trucks weigh 2750 lb. without wheels, axles, boxes and motor. The weight complete without motor is 5400 lb.

The trucks built for the Richmond & Henrico Electric

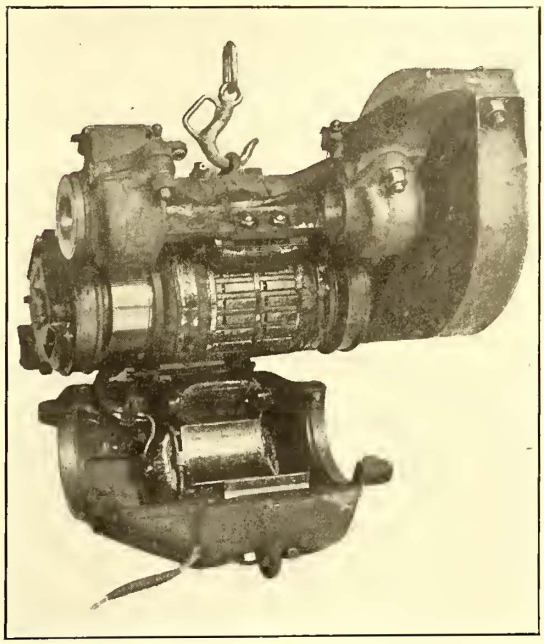
Railway are very similar to those built for the Philadelphia Rapid Transit Company. They have a wheel base of 56 in. and a carrying capacity on the center plate of 20,000 lb. The principal difference between these trucks and those built for the Philadelphia Rapid Transit Company is in the method of supporting the load on the journal boxes of the pony axle. The pony axle journal boxes carry yoke-shaped equalizers and the load is transferred to these equalizers through a coil spring on each side of the box. The driving wheel equalizing beams are arranged precisely like those of the Philadelphia truck and the arrangement of the frames, pedestals and transoms is also the same. The Richmond trucks will be fitted with one Westinghouse No. 310-D motor.

INTERPOLE RAILWAY MOTOR FOR LIGHT SERVICE

Anticipating the demand for a 500-volt to 600-volt interpole motor of 32 hp to 38 hp, to supersede old non-interpole motors in light city service, the Westinghouse Electric & Manufacturing Company has recently developed a new motor, the No. 323, shown in the accompanying illustrations.



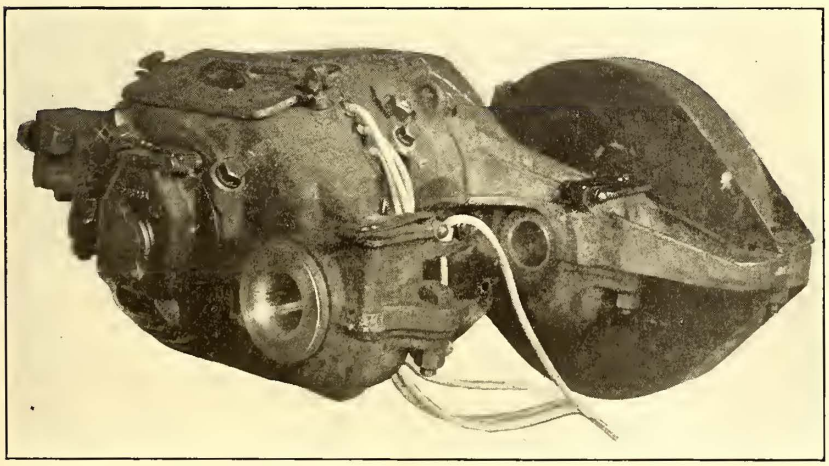
Complete Set of Two-Turn Strap Armature Coils



Interpole Motor, Showing Field and Armature

Among its advantageous features are light weight, split frame, superior spider construction, bolted commutator, strap-wound armature coils and double-stud brush holders.

The frame is of cast steel and is divided horizontally. Armature, bearing housings and field coils may be removed without jacking up the car and removing the truck.



Small-Size Interpole Motor

A large opening is provided above the commutator for ready access to the brush holder. A cover is furnished which is securely fastened to the frame with a T-bolt and a dam-locking device.

The armature and axle bearings each have two separate oil compartments connected at the bottom. The large reservoir is filled with long fiber-wool waste, through which all the oil is filtered while being fed to bearings by capillary attraction. The small pocket is an individual gaging chamber which enables the inspector to measure the oil and thus prevent waste. The field coils are strap-wound, impregnated, and equipped with heavy cushion springs to prevent vibration. In the armature coils wires of rectangular cross section are used to utilize space to better advantage than round wires. There is also a tendency for round wires to cut into the insulation, due both to tension in winding and to chafing in service. Great stress can be applied in winding a strap coil with small likelihood of injuring the insulation, as the pressure is distributed over large surfaces. While being made, the coils and leads are formed into the exact contours they should assume in the armature slots, so that no bending or excessive forcing is necessary to insert or connect them.

The spider armature construction makes it possible to remove the shaft whenever necessary without injuring the windings. The spider also reinforces the shaft so that the probability of bent shafts is reduced to a minimum. The commutators are bolted, a construction to prevent the bars from becoming loose. The mica extends beyond the bars in the rear of the commutator to eliminate the possibility of short circuits between segments. The mica is slotted below the surface of the bars to insure uniform wear on both the commutator and the brushes and also to prevent the flashing and flat spots which are caused by the jumping of the brushes over the high mica.

Bolted Commutator

The weight of the complete motor is 1890 lb. The clearance of lowest point of motor above rail with 30-in. wheels is 2½ in. The minimum distance required on axle between finished wheel hubs is 37 in. The over-all height of the motor is 24½ in.

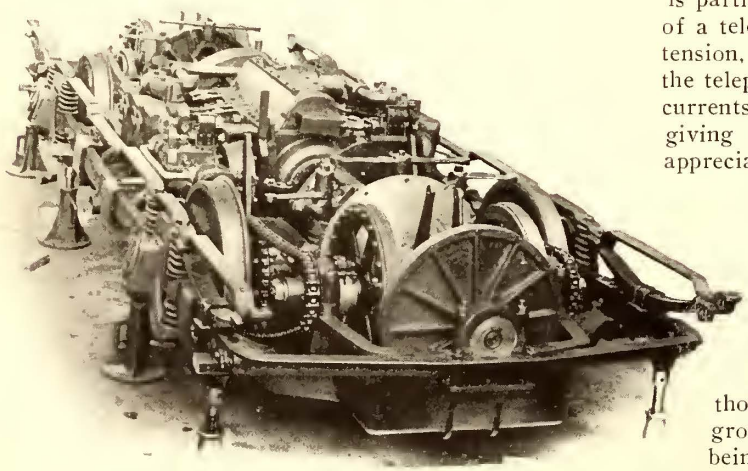
NEW GASOLINE CAR

An article on page 666 of the Oct. 8, 1910, issue of the Electric Railway Journal described a 32-ft. gasoline motor car built by the Railway Motor Car Corporation, Philadelphia. Two of these cars have been built and have been in operation for periods of six and twelve months respectively. One is on the system of the Schuylkill & Dauphin Traction Company, Williamstown, Pa., the other on a branch of the Pennsylvania Railroad at Millersburg,

Type B Car of 60-hp Mounting a 10 per Cent Grade on Schuylkill & Dauphin Railway

Pa. The success with these cars has encouraged the Railway Motor Car Corporation to build a larger, heavier and more powerful car designed for interurban service. This car is known as type C.

The accompanying half-tone engraving of the truck of a type C car show the peculiar friction drive employed. The truck is equipped with a 115-hp, 4-cycle horizontal gas engine carried in the center of the truck and driving a longitudinal shaft provided at each end with two disk wheels 30 in. in diameter. Between these two



Type C Truck

disks on each end of the truck are two additional steel contact disks which are provided with fiber rims, and by a system of levers they may be pressed against either of the driving contact disks. The driven interior disks may also be moved on the shaft on which they are mounted in and out from the center of the driving disks. In this way variations in the speed of the car may be secured without any change in the speed of the engine, which runs continuously. The four driven disks are mechanically connected with each other so that they move in unison, and their position on their shaft is controlled by the motorman from either end of the car.

The weight of the engine, disks and other parts of the motive machinery on a type C car is 5000 lb. and the weight of the complete truck 13,000 lb. The car body weighs about 17,500 lb., making the weight of the car complete, without load, 30,000 lb. The car of the C type illustrated is one of six now being built by the Railway Motor Car Corporation for the Rahway Valley Railroad, Rahway, N. J. Another illustration shows a type B car of the Schuylkill &

End View of Type C Car Mounted on Single Truck with 115-hp Motor

Dauphin Railway mounting a 10 per cent grade. This car has frequently hauled freight cars of 60,000 lb. weight.

Up to the present the manufacturers have confined their output to single trucks, but double trucks may be built.

A TELEPHONE TRAIN-DISPATCHING SYSTEM PARALLELING A HIGH-TENSION TRANSMISSION LINE

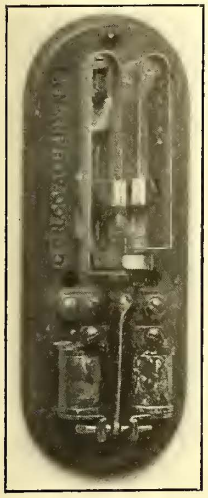
The New York, Westchester & Boston Railroad is now installing a Western Electric telephone installation which is particularly interesting because it is the first installation of a telephone train-dispatching system paralleled by high-tension, single-phase circuits. The method of protecting the telephone user, keeping the cable drained from induced currents from the transmission line and at the same time giving standard transmission, is a problem which will be appreciated by those who have endeavored to operate telephones when used in connection with high-tension distribution lines. The telephone system will be complete, consisting of train dispatchers' circuits and message-wire circuits of various kinds. All the circuits with the exception of the train wires will have intercommunicating features.

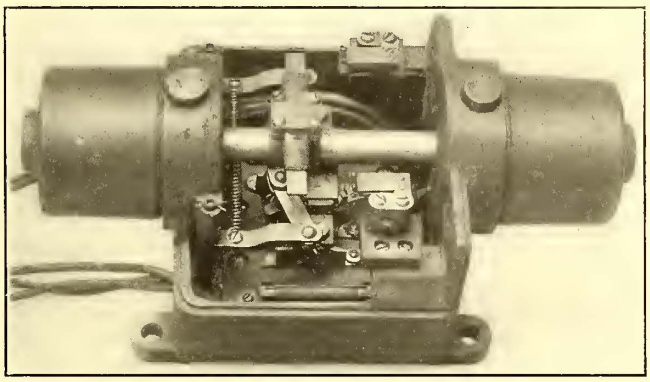
As this road is to be electrically operated by 11,000-volt, 25-cycle, single-phase current it was thought best to make the distribution system of underground cable. Accordingly, a four-duct subway is now being constructed between 180th Street, New York, and Columbus Avenue tower, Mount Vernon. At that point the road branches off, extending to White Plains, a distance of approximately 8 miles. Over this branch and also over the New Rochelle branch, which extends 3 miles from Columbus Avenue Junction, a three-duct subway will be built. The layout for the complete telephone system had to be designed for future extension and to afford good transmission through considerable cable. The dispatcher's office will be located at 180th Street station, as will also the message operator, who will monitor the various message circuits and have charge of the local telephone service.

THERMOSTATIC CONTROL OF ELECTRIC HEATERS AND TILTING HEAT DEFLECTOR

The Consolidated Car-Heating Company has recently put on the market two devices for use on cars with electric heaters. One is an electric thermostat for controlling the temperature of cars by turning the electric heaters on and off at a predetermined point, and the other is a tilting heat deflector.

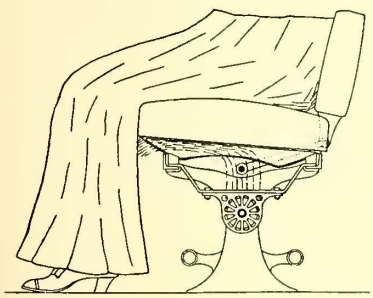
The thermostat proper is made of two metals with different coefficients of expansion, which work according to well-known physical laws and which never vary. Hence when they are once set they can be depended upon to maintain absolutely the temperature at a

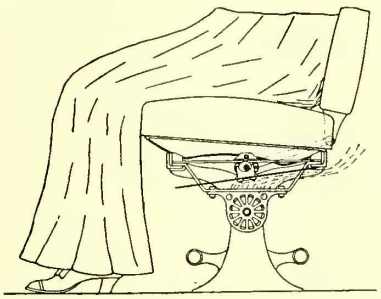




Figs. 1 and 2—Thermostat and Thermostatic Heater Switch

constant point within a degree or two of neutral. The thermostat proper is shown in Fig. 1. It takes current direct from the trolley and operates a thermostatic switch which opens and closes the main heater circuit. There is no arcing whatever on the thermostatic points. Current flows through the main switch only during the moment of





Figs. 3 and 4—Direction of Heated-Air Currents With and Without Deflector

operation, as the thermostat circuit is broken upon completion of the stroke of the switch in either direction. The thermostatic switch is shown in Fig. 2.

One of the advantages of thermostatic control is a large saving in current, because the control of the heaters is taken out of the hands of the train crew entirely. Overheating is prevented both in mild weather and in rush hours, when the cars are crowded. Ten large railways in this country have already adopted this device.

The tilting heat deflector is placed above the electric heater on a cross-seat in order to deflect the heat to the back of the seat and to prevent the pocketing of same. Fig. 3 shows how the heat from an electric heater ordinarily rises from the heater; that is, the seat being high at the front, the heated air naturally goes to the front of the seat. This makes a heat pocket and prevents free escape of the heat to the car body proper. Fig. 4 shows the free radiation of heat when the deflector is used. This rocks with the seat and directs the heated air always to the back of the seat, thus allowing free escape and utilization of every heat unit possible. The deflector is made up in many different styles so that it can be attached to all classes of standard seats.

ROLLER BEARINGS ON SUBURBAN CARS

The Frankford, Tacony & Holmesburg Street Railway, which operates a suburban line 8 miles long between Frankford, on the outskirts of Philadelphia, Pa., and Torresdale, placed in service four months ago two Brill semi-convertible double-truck cars, equipped with Rollway journal bearings made by the Railway Roller Bearing Company, Syracuse, N. Y. These cars are mounted on Brill-39-E trucks and each truck carries one GE-216 hp motor of 50 hp. The cars weigh 38,000 lb., without passenger load, and have a seating capacity of forty-six. At times as many as 140 passengers have been carried, making a total weight of car and passengers of close to 60,000 lb. The two motors, which total 100 hp, are sufficiently powerful to propel these cars at an average speed of 15 m.p.h., although the line has several long grades of as much as 3 per cent. This result is attributed largely to the low friction losses in the bearings.

Henry Glazier, superintendent of the railway company, states that while no power consumption tests have been made with these cars observations of the ammeters in the power station show that they require only about 10 per cent more current than the light thirty-six-passenger, single-truck open cars of the company. The bearings have required very little attention, and are lubricated only once in two months. After four months' service they show no signs of wear.

The journal boxes installed in these two cars were the first bearings to be placed in operation with double-end thrust bearings as distinguished from the single-ball thrust bearings which were previously furnished by the Railway Roller Bearing Company. During the past four months all journal boxes installed by this company have been of the double-thrust bearing type. The double-thrust type of bearing is said to be more efficient than the single-thrust type, and has the advantage of requiring no adjustments whatever after being placed in operation. It is said that it prevents any end movement of the box and rollers relative to the journal sleeve, regardless of any flexibility in the truck frames or the amount of play which exists between the pedestal and the box.

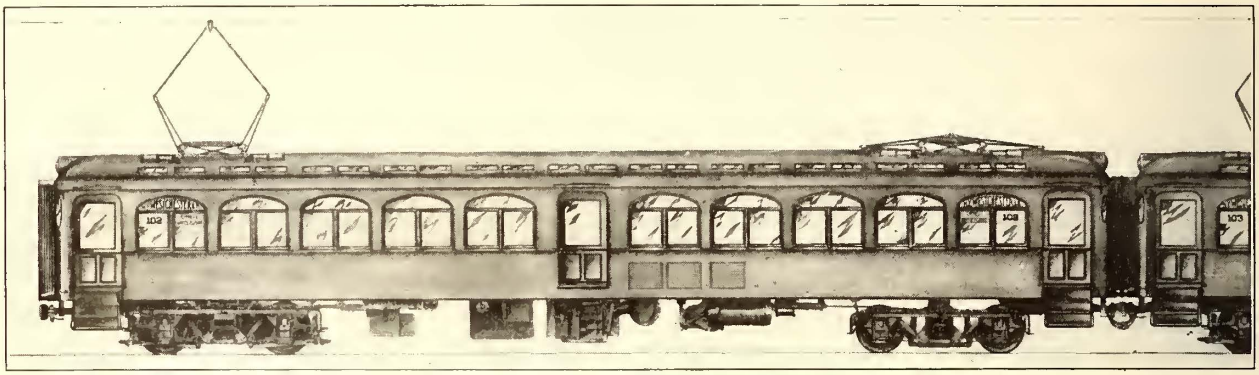
SOAP FOR CAR WASHING

The J. B. Davies Company, Dayton, Ohio, is marketing a soap known as the "Buckeye Cleanser," which is made expressly for washing painted and polished surfaces of steam and electric cars. It is described as a strictly neutral non-alkaline oil soap for use without the slightest injury to the finish on any surface that will stand clear water. This material is highly concentrated, as 10 lb. of it dissolved in 50 gal. of water will serve for 100 3-gal. pails of washing water, while one 400-lb. barrel will take care of 4000 pails or 12,000 gal. of washing water. This cleanser is distributed by the manufacturers from forty-six warehouses throughout the United States and Canada so that quick delivery can be made at all times.

METAL UNIT-SECTIONS FOR CAR CONSTRUCTION

The New York, Westchester & Boston Railway, of which L. B. Stillwell, New York, is consulting electrical engineer, will soon receive the first of its new steel motor cars. These cars will be 72 ft. ¾ in. long over coupler faces, will be fitted with full vestibule and buffer platforms and will have a seating capacity for seventy-eight passengers. The cars are equipped for single-phase operation with two Westinghouse No. 409 motors mounted on one truck.

The design of these large car bodies, which was made in the office of the consulting engineer, is of particular interest because it includes the use of pressed-metal side unit-sections. Accompanying illustrations show the characteristic appearance of these sections before assembly. The sections are manufactured by the Forsyth Brothers Company, Chicago, to suit any design of car for city, interurban or steam-railway service. The chief advantages claimed for these unit-sections are increased car-body strength and decreased weight as compared with car bodies built up of commercial plates and sections. The unit-sections are pressed to conform to the desired outside contour of the car and are finished with L-shaped flanges of such dimensions that the unit is rigid. Each unit-section extends from the center of one pair of windows to the center of the next, and includes the fully formed pier post, together with a complete letterboard section which needs no additional plating and three extensions below the level of the arm rail to connect with the underframe and securely stay the upper part of the car against longitudinal movement. The manufacturer is prepared to press these sections to conform to any design of body structure.

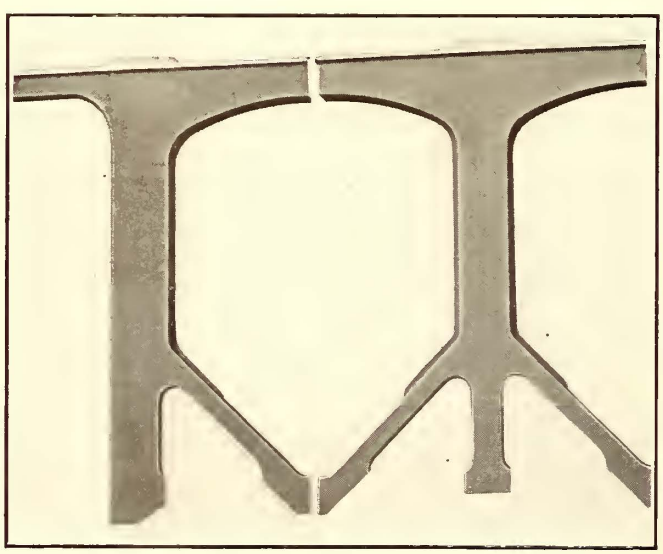


Steel Motor Car for New York, Westchester & Boston Railway

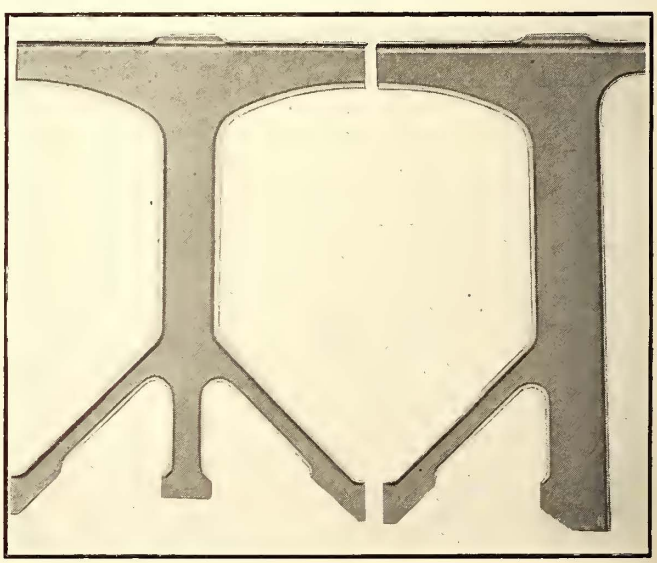
One advantage claimed for this type of car construction is that of low cost of making renewals after a car body has been damaged. In such an event any damaged unit-section could be replaced by another of standard design, and since all sections of the same design would have been pressed by the same dies, the work of fitting the joints would be greatly lessened.

The advantages with regard to decreased weight and increased strength which this form of pressed metal side unit-section car construction offers as compared with the building up of a car body from commercial plates and sections should command careful attention. The need for reducing car weights is now so well recognized that every means available for avoiding unnecessary weight, providing the car structure is not weakened, is being given consideration by car designers. The pressed unit-sections are the result of considerable experimental work. A large plant for the manufacture of these parts is now being completed near Chicago.

The manufacturer states that in designing this unit-section it has been the aim to provide more than the usual strength for service conditions and at the same time press the sections from such light material that when assembled in a car the total weight would be less than that for the usual type of steel-car construction. The rapid and economical repair of injured cars also has been considered, and therefore these sections have been formed in units of such length as to permit ready removal for repairs. The forming of the sheets and the various designs with L-shaped flanges assits the material in carrying its load and resisting cross strains and permits the use of much thinner steel than otherwise would be possible. This pressed-unit side construc-



Outside of Unit-Section Car Side

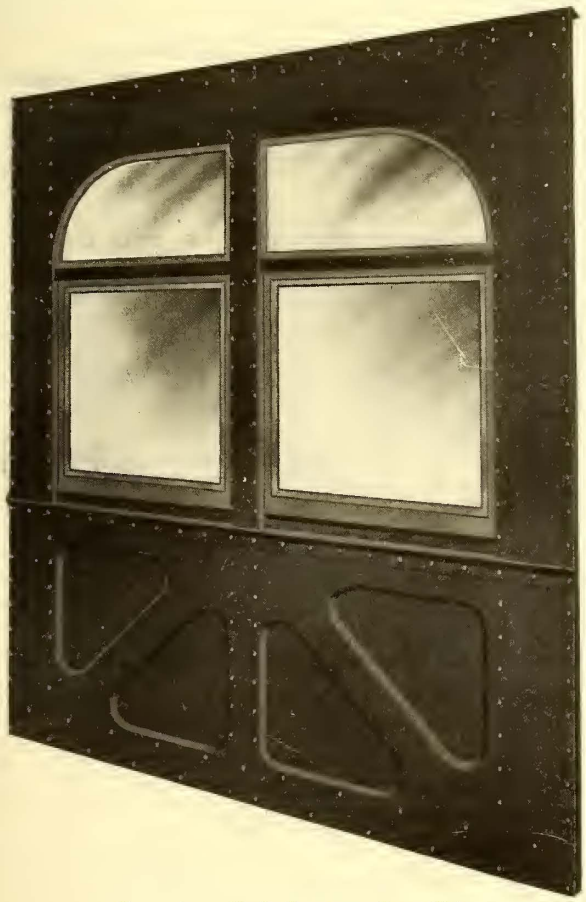


Inside of Unit-Section Car Side

tion was employed in the design of the Hudson & Manhattan cars, and was chosen because by utilizing the full height of the car side as a girder (with the windows framed in the structure) a car of extraordinary strength and rigidity could be built with minimum weight.

The elimination of many rivets is a desirable feature to be obtained by the use of pressed unit-sections for car sides. With a riveted-steel structure any bending tends to stress the rivets and eventually to loosen some of them. The presence of riveted joints also increases the weight over that of a formed section. Consideration of the need for reducing the number of riveted joints in a car structure and thus obtaining rigidity at lower weight led to the design of the pressed unit-section, wherein the side posts, diagonal braces, letterboard, etc., are formed of one sheet of steel. Severe service conditions have shown the advantages of this form of construction, which practically surrounds the passenger with a steel shield. The buffing shocks, if desired, can be transferred by the end sills to the side structure, and thus the center-sill construction may be made comparatively light.

The manufacturer furnishes these sections in any size



Complete Unit-Section Car Side

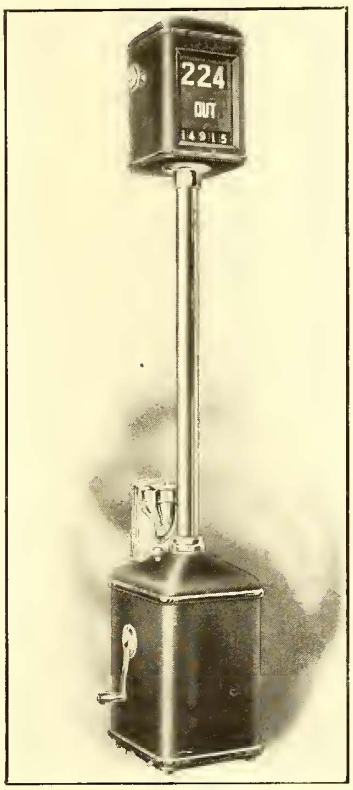
direct to the railroads or to the car builders. The Forsyth Brothers Company also manufactures a variety of other metal parts for car construction, including one-piece metal doors, self-adjusting metal sash in brass and steel, metallic weather strips, the Doyle and other designs of metal car posts, metal car lines and buffing and draft devices for all classes of equipment.

An accompanying illustration shows a unit-section as assembled for a city car, including the use of pressed sheathing riveted to the body framing and so designed that the sheathing serves as a side girder. With this form of construction rectangular or Empire windows with wood or metal sash may be used. These pressed sections may be had also for interior car finish in accordance with the designs of railroad or car-building companies.

A NEW COIN REGISTER FOR PREPAYMENT CARS

The International Register Company, Chicago, Ill., has added to its well-known line of registers a new type which has been especially designed to meet fare-collection requirements on any type of prepayment car. The accompanying cut shows the standard arrangement for pay-as-you-enter cars. On pay-within cars, where the register is mounted on the control stand from which the doors are operated, the crank for operating the register is located on the column on the opposite side from that shown in the cut; the conductor's change door is also on the other side.

The coins received are cents, nickels and dimes. When quarters are put into the hopper they are retained at the top so they may be readily withdrawn by the passenger. Anything anywhere near the size of the smaller coins named will go through the holes in the hopper and will be registered according to the diameter, after which it is immediately accessible to the conductor for return to the passenger, should he find that the coin is not current. Dirt and small objects, such as matches, nails, screws, peanut shells, etc., are automatically removed without passing through the counting mechanism, provided they are smaller in diameter than a dime. Objects smaller than a dime and larger than a nickel are retained without interfering with the registration of the coins.



Coin Register for Prepayment Cars

The hopper includes a cylinder of thick glass 3½ in. in diameter and 4¼ in. high, which is mounted securely on the case with a metal frame having four vertical rods to protect the glass on the outside. The top of this frame supports a bowl having five bottom holes which are a little larger than a nickel in diameter to stop larger coins from going down. A five-pointed casting in this bowl, with ridges between the holes, prevents balancing a coin anywhere on the top of the hopper, unless it is larger than a nickel. The shape of the bowl is such that coins thrown in the hopper or dropped on it will immediately pass down on to the trap door at the bottom of the hopper, where they may be inspected. After inspecting the coins the trap door may be opened by a slight left-hand or reverse movement of the operating crank. This greatly simplifies the operation, because the right-hand rotation of the same crank registers the coins.

From the trap door the coins drop through a 1½-in. diameter tube into a pan of original design. On turning the crank to the right the coins are picked up one by one in the holes in the bottom of the pan and are carried into the counting mechanism, where they are counted by a mechanism which is so positive that the crank may be turned by hand as fast as possible without causing an error in the count. The counting can be accomplished at the rate of four coins per second. An extremely high speed of the crank does not facilitate the counting, as more coins will be passed through per minute at a speed below the extreme

speed. After counting the coins are delivered into the conductor's coin box at the bottom of the machine. This box has a capacity of about 100 fares, and could be made larger if desired. The door to this receptacle is operated by the thumb of either hand, while the fingers are held so as to receive the coins which come down the snout on the door into the palm of the hand.

The counting mechanism is connected directly to the register above through a shaft in the column, and both the trip register and the totalizer are driven from this shaft by positive gearing. The trip figures are 1¼ in. high and ¾ in. wide, and read to 999. The trip counts one for each nickel, two for each dime and one for each five cents. The trip may be reset by a knob on the left when the crank is in the down position only, as it is interlocked with the crank through a rod in the column. During the process of resetting the crank is locked against operation, and during the process of registration the resetting knob is locked so it cannot be operated.

The totalizer figures are ½ in. high, reading to $999.99. Both the trip and totalizer figures are lithographed on steel, showing white figures on black background, this being the same method used satisfactorily for many years in this company's type R5 register. The bell is 4 in. in diameter, which is much larger than the ordinary register bell. It is located in the extreme top of the register in a separate compartment having an opening all the way around the case for the emission of the sound. As the bell is in a separate compartment, no dust can find its way into the register. The bell rings once for each nickel, twice for each dime and once for each five one-cent pieces.

The direction indicator is located between the trip register and the totalizer. It has letters 1 in. high, which can be plainly read from any part of the car. In order to be of any value the trip register must be reset at the end of each trip, and the only means of checking this is by means of the direction indicator.

The case is made of heavy rolled phosphor bronze, with statuary bronze finish to give maximum stiffness for minimum weight. On account of the dark color of the phosphor bronze it should present a neat appearance even after the finish is worn off. The case on the upper part is held by a latch controlled from the lower part. The lower case is made in two pieces, separating horizontally at the crank, the upper part containing a glass signature seal similar to that used for many years on "International" registers. In breaking this seal and pushing a lever a lock on the column nut is released so this part can be unscrewed and the column and upper part removed. Then the upper part of the case may be lifted off, taking with it the hopper and trap door. The lower case may then be removed by taking out three screws, which leaves the entire mechanism exposed. The column is so located that it will be used more or less as a grab handle by passengers. Therefore the frame is made very stiff to provide for this condition. At the same time, the frame can be readily taken apart to get at the mechanism.

The counting mechanism is mounted in a separate frame, complete in itself, which may be removed by taking out four screws after the case is taken off. Below this is the coin-handling mechanism, which has its own frame and may be removed by taking out two more screws. The trip register and totalizer also has its own frame. All of these separate frames may be taken apart in a very short time should repairs be necessary. The coin-handling parts are made of tempered tool-steel gears and the principal wearing parts of a hardened alloy steel. The bearings are of phosphor bronze. Only six springs are used in the coin-handling and counting mechanism and five in the register. All are of the compression type, mounted on rods, so that a broken coil does not interfere with their operation.

All parts are made with accurate special tools and dies and tested with limit gages. The degree of interchangeability obtained is believed to be equal to that in any other small machine on the market. The total weight of the machine is about 35 lb., depending on the height of the column. The latter may be made to suit the particular type of car for which the machines are ordered.

In mounting this apparatus in pay-as-you-enter cars a bracket is fastened to the bulkhead between the two doors and near the rail separating the conductor from the passengers. This bracket has two holes into which two pins on the bottom of the machine enter. Above the window is located another bracket, which supports the top of the machine by means of a sleeve which passes over a pin on the top of the trip register. In removing the register to transfer it to the other end of the car it is lifted against the spring on the sleeve until the lower pins are removed from the holes on the bracket and then may be lifted backwards a little and dropped to release it above. On pay-within cars the machine is mounted in the same way at the bottom on a bracket attached to the control stand from which the doors are opened. The support above is from a bracket on the underside of the car roof.

CLOTH PINIONS

The General Electric Company has developed a line of cloth pinions for shop tool and other service which are asserted to be noiseless, self-lubricating and unaffected by moisture and changes in temperature. The blanks from which the pinions are cut consist of a filler of cotton or similar material confined at a pressure of several tons per square inch between steel side plates, the whole structure being held together by means of rivets, or in the case of very small pinions by threaded sleeves. The teeth are cut to the 14½ deg. involute system according to Brown & Sharpe's standard. Diametral pitch is the standard of measurement, and companion gears should be cut to similar form. The teeth are said to be stronger than those of any other type of non-metallic pinion and are sufficiently elastic to allow the meshing teeth to bear evenly across the full width of the face, thereby enabling the combination to absorb shocks which might fracture cast iron or brass. After the teeth are cut the cloth filler is impregnated in oil, thereby making the pinions self-lubricating. Ordinarily non-metallic pinions constitute the smaller members of the gear train, but practically any size and form of gear can be obtained.

BRUSHES TO INCREASE OPERATING EFFICIENCY

The National Carbon Company, Cleveland, has developed three types of brushes for dynamo-electric machines, known as the Cophite, Graphoid and Laclede 255-G brands, which are said to have the requisite requirements of an efficient brush, namely, small coefficient of friction combined with high thermal conductivity and mechanical strength.

Cophite brushes are made in six grades from a metal-graphite composition that insures the maximum carrying capacity consistent with a small coefficient of friction. They are especially adapted to high-current generators operating at low peripheral commutator speeds and for slip-ring work. Graphoid brushes are made from a nearly pure graphite composition in five different grades. The lowest coefficient of friction consistent with good carrying capacity makes this brush especially desirable for d.c. generators, slip-ring machines and even for a.c. turbo-generators.

The Laclede 255-G brush has been developed for direct-current generators operating at high commutator peripheral speeds and for railway motors. The coefficient of friction is very low and the mechanical strength high. The resistance of the brush is proportioned to help commutation by damping out the current in the short-circuited coils.

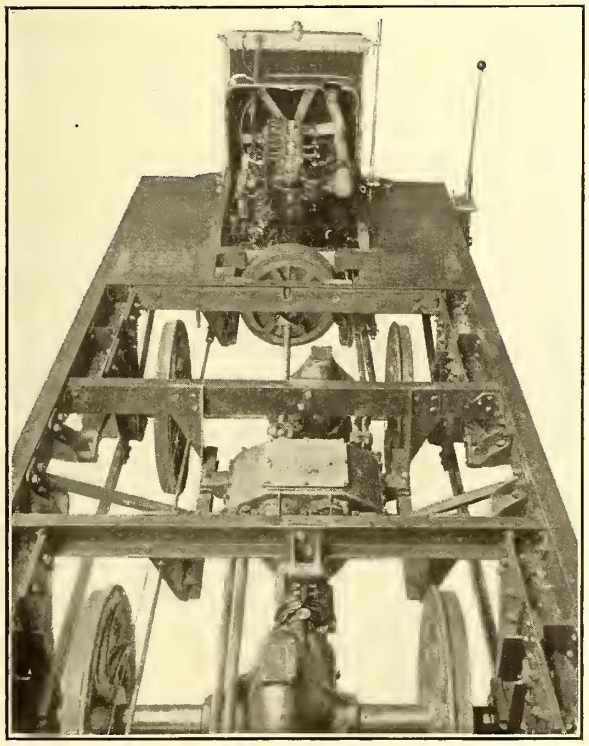
GASOLINE CAR FOR DUTCH WEST INDIES

The availability of a self-contained vehicle for small, isolated railways is shown by the recent shipment of a gasoline car to Curaçao, Dutch West Indies, by Sidney Straker & Squire, Ltd., of London, Eng. This car is constructed to run on street railway lines. As shown in the accompanying views, it is fitted with an open-type body to accommodate thirty passengers, there being six transverse seats for five passengers on each seat. All seats except the two end ones have turnover backs. The general dimensions are as follows: Over-all length, 22 ft. 4 in.; over-all width, 7 ft. 6 in., and wheel base, 6 ft. The cars can be built for a rail gage of 3 ft. 6 in., as in this case, or for the standard gage of 4 ft. 8½ in.

The underframe is of channel steel, well braced by cross members connected by gusset plates. The car is carried on two axles fitted with 30-in. diameter wheels, and both axles are driven. The power is transmitted from the motor to the gear box through a leather-faced cone clutch fitted with ball thrust withdrawing bearing. At the engine speed of 900 r.p.m. the gears provide three speeds—5 m.p.h., 10 m.p.h. and 15 m.p.h.—in either direction. The gears are of the sliding type, and are case-hardened.

Power is transmitted from the gear box to the axles by a bevel reducing gear, one on each axle. The gearing runs in thick oil or grease, and is inclosed in oil and dust-tight, cast-iron casings. The driving shafts from the gear box have universal joints to allow for the play of the springs.

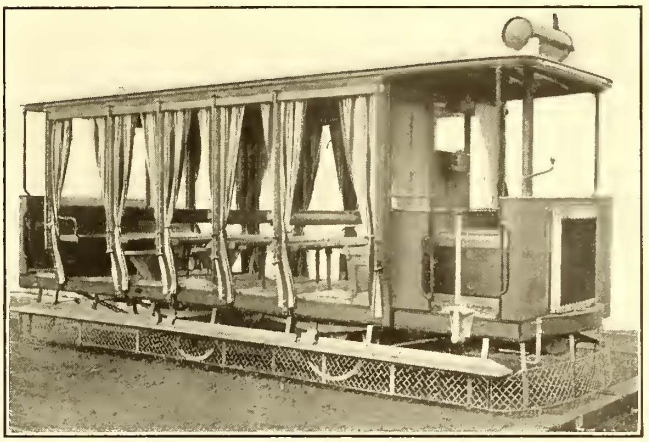
The motor is fitted at the front of the frame, inclosed by a suitable sheet-steel casing. It is of the four-cylinder, vertical type, with cylinders 5 in. x 5⅛ in., and developing upward of 32 b.h.p. The principal feature of the engine



View of Truck Showing Gasoline Engine and Driving Equipment

consists in the placing of the cam shaft which actuates the inlet and exhaust valves, as well as the ignition tappets on the top of the cylinders. By this means the inlet and exhaust valves are arranged at opposite sides of the cylinders, and actuated with one common shaft which is driven off the crankshaft by means of skew bevel gear and a vertical shaft. The cam shaft and cams are one forging of nickel steel. Motion is transmitted to the valves by means of the rocking levers at each side. This arrangement is used to insure great certainty of action with the least wear. The case-hardened cam shaft and rollers at the end of the rocking levers run in an oil bath.

The easy access to the valve gear renders the engine highly suitable for railway work. The entire valve gear



Gasoline Street Car for Service in Curaçao, Dutch West Indies

and cam shaft can be readily removed as a self-contained whole by unscrewing a few bolts. All valves are mechanically actuated and are interchangeable. The valves are readily removable through the openings immediately below them, which are closed with flanged pieces. As this equipment is placed on the top of the cylinders doors can be provided on each side of the crank chamber, to give access for adjusting the connecting rods and crankshaft. All valves are made of nickel steel, with thick stems.

The cylinders are cast in pairs, and the water jacket is so arranged that both the explosion chambers of the cylinders and the valve chambers are completely surrounded. The water is let in at the exhaust side of each pair of cylinders, and passes out at the inlet side to the tubular radiator at one end of the chassis. A belt-driven fan is located behind the radiator. The crank chamber has three specially long bearings for the shaft, these having split bearings of phosphor bronze faced with white metal. The connecting rods are of "H" section, to secure exceptional lightness. All connecting rod bearings are lined with white metal. The crankshaft is in chrome nickel steel. The crankshaft bearings and the big ends are lubricated on the splash principle, as well as with a force feed by an oil pump.

The carburetor is of the jet type, fitted with auxiliary air valve; situated just below it is a valve which can be operated by the driver to vary the proportion of air as required. The ignition is obtained by the use of a high-tension magneto.

To the vertical shaft is fixed a governor, which acts directly on the throttle of the engine. The throttle can also be controlled from the driver's seat, securing a variation of speeds from 300 r.p.m. to 900 r.p.m.

The actuating equipment is removable from end to end, and comprises the following: Lever for actuating clutch, lever for change speed gear and pedal or controlling engine throttle.

The brakes are actuated by means of a ratchet handle, fitted at both ends of car.

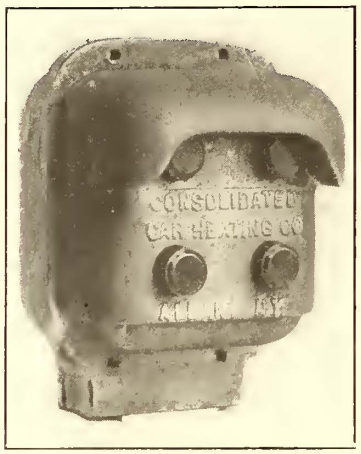
A pedal-operated sand box of the intermittent flow type is fitted at each side.

The exhaust silencer is carried on the roof of car, the exhaust pipe being carried direct up from motor and passing through the roof. A petrol tank of 30 gal. capacity is fitted under one of the car seats.

HORN-GAP TYPE OF CIRCUIT-BREAKING APPARATUS

The Railway & Industrial Engineering Company, Pittsburgh, Pa., is manufacturing a line of high-voltage switches, fuses and lightning arresters which operate on the principle that an arc can be extinguished on a pair of diverging horns. The switches are intended to open a loaded circuit without causing any voltage disturbance to the system other than that occurring from a change of current. They are so constructed that their operation is not affected by a heavy coating of ice, sleet or rain. They are now in operation on high-tension systems carrying current ranging in potential from 11,000 volts to 44,000 volts.

The current entering the middle of a switch is carried jointly by means of a heavy switch blade and diverging horns to the switch jaws and thus to the outgoing line. These shunted horns are so arranged that when the switch is closed there is considerable torsion in the center horns. Thus when the switch is opened the switch blade leaves the switch jaws while the horns are in contact. When the switch is opened further the arc starts and extinguishes itself, due to the widening of the gap, which is brought about by the joint action of the switch opening and the arc rising on the diverging horns.



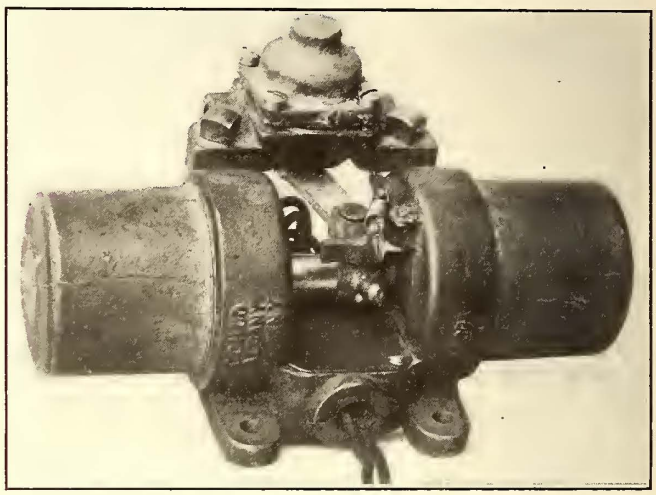
The switches are manufactured in single-pole units, each unit consisting of a stationary and a movable casting. In the stationary casting there is a brass bearing. The movable casting has an extended stem, part of which is machined to fit this bearing, the remainder being squared off to receive a bell crank or sheave wheel for operating several switches simultaneously. A high-voltage porcelain insulator is cemented on the extended arms of each of the movable castings. Each insulator top has a removable sherardized iron cap to which the switch blades, horns and jaws are bolted. Provision is made for grounding so as to afford protection to the operator.

Following the successful operation of these switches this company has placed on the market other disconnecting apparatus which operates on the same general principle. This apparatus includes high-tension fuses and a combination horn-type lightning arrester and spade-type choke coil

Horn-type switches have been found particularly desirable by transmission companies for supplying loads as small as 10 kw without using the more costly oil switch. This type of apparatus has also been used in sectionalizing transmission lines to insure continuity of service and for use as outdoor cut-outs on the high-tension side of substations. Air-break switches of this type can be placed in portable substations as substitutes for automatic circuit-breakers.

PNEUMATIC DOOR DEVICES

The Consolidated Car-Heating Company has placed a new electro-pneumatic door device on the market within the last year. While the device proper operates by compressed air the valve is controlled electrically, there being a solenoid for operating the valve in either direction. The valve is built on the latest approved electrical lines and is entirely iron-armored and arranged for conduit connections, so that it can be placed in an exposed position in the car if desired.



Figs. 1 and 2—Push-Button and Solenoid for Operating Pneumatic Valve for Door

Instead of using pressure air for checking the motion of the door at the end of its travel atmospheric air is used, and a separate cylinder is provided for compressing it by the motion of the door. This prevents the slamming of the door, should it be held up at any point in its travel and then released, because the ports are all designed for low-pressure checking.

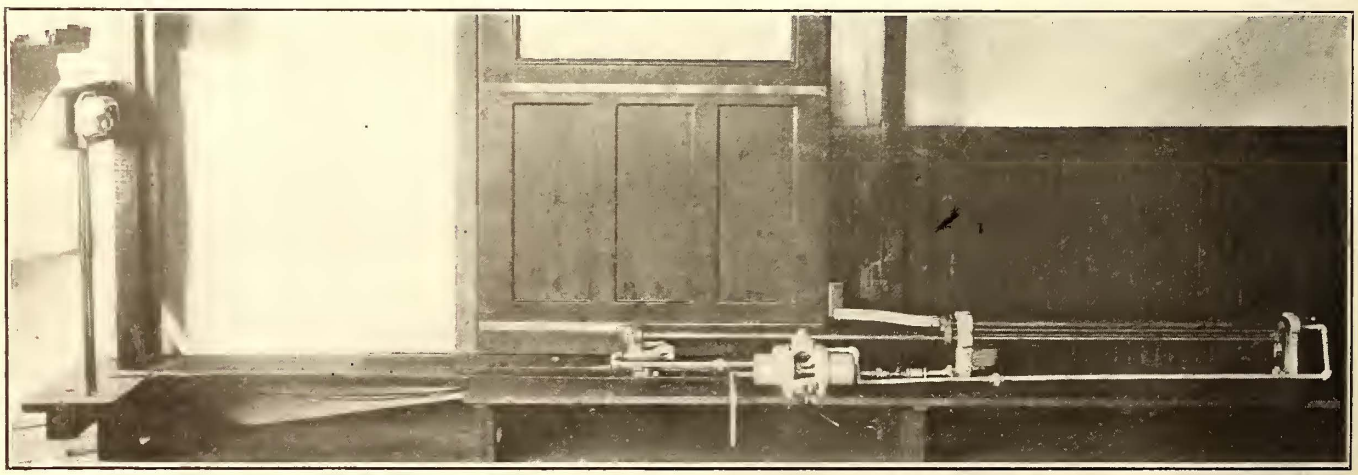


Fig. 3—Electrically Controlled Pneumatic Door-Operating Device

Fig. 1 shows the push-button, Fig. 2 the valve and Fig. 3 the two-button switch group for controlling two doors. These switch groups are also made for controlling both motions of one, two or three doors.

No gears or racks are used, inasmuch as the device operates on a straight line back of the door and the cylinder extends the full length of the door travel.

News of Electric Railways

Boston Subway Leases Submitted

Drafts of the contracts between the city of Boston and the Boston Elevated Railway, whereby the latter leases the new subways and tunnel extension, are now in the hands of the company. They have been drawn by the Boston Transit Commission, which acts for the city, and have been sent to the company. To become effective they must be signed before Dec. 21, 1911. The merger act is going into effect by successive stages, and the signing of the papers, now in the hands of W. A. Bancroft, president of the Boston Elevated Railway, will be the last act required to give the law full force. When they are signed the Transit Commission may go ahead with the work of construction. Precisely how the provisions of the merger act have gone into effect, by degrees, as the parties to it have passed upon it, is shown in the following summary and announcement given out by the Transit Commission:

"Chapter 741 of the Acts of 1911, entitled 'An Act Relative to Electric Railway Transportation Facilities in the City of Boston and Its Vicinity,' and providing for the construction of the Dorchester tunnel, the Boylston Street subway, the East Boston tunnel extension, and the extension of existing subway and tunnel leases until July 1, 1936, goes into operation by successive stages.

"Section 14 of this act, providing for preliminary investigations, surveys, etc., by the Boston Transit Commission, took effect upon the approval of the act, July 20, 1911, and this work was at once entered upon and has made rapid progress.

"The act further provides that its remaining provisions shall not take effect until accepted by vote of the City Council of Boston, approved by the Mayor and by the Boston Elevated Railway, by vote of its board of directors, subsequent to action by the stockholders of the West End Street Railway. This latter action was taken on Sept. 6, 1911, and the act was accepted by vote of the board of directors of the Boston Elevated Railway on Sept. 13, 1911, and by vote of the City Council of the city of Boston, passed on Sept. 18, 1911, and approved by the Mayor on Sept. 21, 1911.

"The next step required by the act before the work of constructing the new subways and tunnels can be begun is the execution of contracts between the city of Boston, represented by the Boston Transit Commission, and the Boston Elevated Railway, covering the use of the new subways and tunnels and making the extensions of the existing leases. The act provides that such contracts must be executed within ninety days after the act takes full effect; that is, within ninety days from Sept. 21. With a view to expediting further action as much as possible, the Boston Transit Commission has already prepared drafts of the leases of the new subways and tunnels and of the extensions of existing leases and has submitted these to the Boston Elevated Railway."

Los Angeles Mayor on Franchise Conditions

Mayor Alexander of Los Angeles, Cal., concluded in part as follows his recent special message to the Council of Los Angeles in regard to franchise terms which he feels should be imposed in future grants made by the City Council:

"In the first draft of the proposed general ordinance now pending before your legislative committee it was provided that the companies should pay the city 30 per cent of the net profits derived from the exercise of any franchise to be granted after the passage of that ordinance. It is a serious question whether the city should receive any part of its income in this way. Suppose, for instance, that the entire revenue of the city was derived from its share of such net receipts. That would practically relieve the wealthy property owners from tax burdens. It is far better that the benefit be derived in the shape of better service or lower fares.

"Under the present system our franchises are granted for twenty-one years. Some of the older franchises were granted for fifty years. These various franchises expire at many different times. Recently it has been the custom to provide that franchises for extensions shall expire at the same time with the franchise for the line of which the extension is a part. Thus it is hoped that eventually all the franchises will expire at the same time, thereby giving the city the opportunity to take over the entire system at once. If this purpose were accomplished it would mean that during the last few years of the life of the franchises the street car systems and their equipment would be allowed to deteriorate. The remedy, as I see it, is the indeterminate franchise; that is, a franchise which provides that at any time after due notice the city may end the franchise and take over the property used in the exercise thereof. The terms of such a franchise, however, must be equitable. Indeterminate franchises enable the termination of all franchises of that kind at the same time. They also tend to induce the holders of the franchises to give good service, because they would know that poor service would mean municipal ownership.

"It is the duty of the Board of Public Utilities to determine the value of the properties of the electric light and power companies and each year to fix the rates charged by them. If we are to regulate the street railways it is just as necessary that the Board of Public Utilities investigate the railway companies, the value of their properties, the income, expense, etc. This investigation should be made not alone for rate-fixing purposes. It should be the duty of the city to see that proper service is provided and that extensions are made where the growth of the city demands it.

"In view of the pressing need for crosstown and other car lines, I would recommend that at an early date and before any more franchises are granted your honorable body declare the general policy of the city in regard to the granting of franchises, and that the matter of such car lines, upon proper terms, be brought to an early issue. I would also recommend that you grant the request of the Board of Public Utilities for the authority and for the funds necessary to investigate the street railways of this city."

Through Routing Considered in Cleveland

Newton D. Baker, city solicitor of Cleveland and candidate for Mayor on the Democratic ticket, has made a feature in his campaign speeches of advocating through routing of east and west lines instead of looping at the public square. In view of the ideas advanced by him Mr. Baker was invited to attend the meeting of the street railway committee of the City Council on Sept. 28, 1911, to explain his plan before the Haserodt resolution which provides for this change is reported to the Council. Mr. Baker stated that a study of the service should be made on both the east and west sides to determine whether cars could be routed through instead of looped at the square. He thought that running the cars through would be economical and would avoid congestion and danger at the square. G. M. Dahl, street railway commissioner, replied that the study had been made and that it would mean a loss of money to run the cars through. Mr. Dahl asserted that if the east and west cars were routed through the operation of two lines instead of one would be interfered with every time there was delay at the Superior viaduct. Another point was that the east and west lines were operated on different schedules. Chairman Kramer intimated that the report of the committee would be against the Haserodt resolution and that the routing would remain as at present.

The suit brought by A. G. Stafford to compel the interurban railways to operate their cars at a straight 3-cent fare within the city limits was heard before Judge Vicery, beginning on Sept. 27, 1911. D. R. Wilkin, of Kline, Tolles & Morley, attorneys representing the companies, argued that these cars were brought into the city by other

companies under contract allowed by statute and that the fare should not be reduced from 5 cents to 3 cents. Attorney George D. Hile, representing Mr. Stafford, insisted that the State laws require interurban railways which enter cities to operate at the same rate of fare as do the urban companies. The court reserved decision.

Hudson & Manhattan Railroad Extends Its Line in New Jersey

The Hudson & Manhattan Railroad, operating between New York and New Jersey, ran its first train to Manhattan Transfer, on Sept. 28, 1911, making the distance of 8 miles in fifteen minutes, one minute better than scheduled. This adds eight miles to the Hudson & Manhattan Railroad and brings the line within 0.8 of a mile of Newark. It is at this point that the Hudson & Manhattan Railroad and the Pennsylvania Railroad will exchange passengers. Regular passenger service was begun on Oct. 1, at 12:01 a. m. This line will open through service from Manhattan to Jersey City, including the Henderson Street and Summit Avenue stations. When construction is carried on to Newark it will leave only the extension in New York from Thirty-third Street to the Grand Central Station to complete the system. The first run carried a five-car train and included about forty officials of the Hudson & Manhattan Railroad and the Pennsylvania Railroad. Thirty-four trains will be operated each way on week days and twenty-eight on Sundays between the terminal and Manhattan Transfer.

Recommendations in Regard to Track Return.—The city authorities of Dayton, Ohio, have made some suggestions to the Ohio Electric Railway, Cincinnati, Ohio, of a minor nature in regard to track return, such as insulating track joints, and where the company is affected by the recommendations the matter will be given proper attention.

Everett Plans to Purchase Water System.—The Council of Everett, Wash., has passed an ordinance looking to the acquisition of the present water system of the city, which is owned by the Everett Railway, Light & Water Company, at a price to be determined at a conference between the Board of Public Works of the city and the officers of the company.

Strike on Trenton, Bristol & Philadelphia Street Railway.—The employees of the Trenton, Bristol & Philadelphia Street Railway, which operates 17.5 miles of electric railway connecting Philadelphia, Bristol, Tullytown, Morrisville and Trenton, went on strike on Oct. 1, 1911. The men demand an increase in wages, recognition of the union and other changes in the terms of service with the company.

Strike in Chihuahua.—On Sept. 26, 1911, the Compañia Electrica y de Ferrocarriles de Chihuahua, S. A., Chihuahua, Mex., announced that the places of its employees who went on strike recently had all been filled and that the former employees need not apply for reinstatement. Rioting attended the inception of the strike, and as a precautionary measure the company announced that it would not operate cars at night until the new men were familiar with their work.

Strike in Spartanburg.—The strike of the employees of the Spartanburg Railway, Gas & Electric Company, Spartanburg, S. C., which was declared on Sept. 20, 1911, was terminated on Sept. 26, 1911, by the men agreeing to return to work under the conditions fixed by the company. On Sept. 24, 1911, the strike assumed such serious proportions that Governor Blease ordered three companies of the State militia to hold themselves in readiness for service in Spartanburg to suppress disorder.

Bill Passed to Facilitate Subway Work.—Under an emergency message from Governor Dix both houses of the New York Legislature passed, on Sept. 29, 1911, the bill introduced at the instance of the Public Service Commission of the First District which repeals a law enacted early in the session requiring that contractors on public works furnish a bond to the amount of one-third of the contract to protect the dealers who provide the materials. It was found that contractors experienced difficulty in furnishing bonds of such large amounts and that the subway contracts in New York would be delayed under the law.

Financial and Corporate

New York Stock and Money Markets

Sept. 30, 1911.

The week just closed offered a strange medley in price changes. The market was violently active, with Steel common the center of interest. On Monday Steel common sold down to 51⅝, the lowest price in two years, but at the close of the week it had advanced 10 points from this low price. Four of the six trading days were million-share days, and the total transactions for the week reached 6,655,000 shares. The increased activity in the bond market was even more pronounced, although the total value of bonds sold on the Stock Exchange exceeded only slightly the record for last week and the corresponding week two years ago. In the money market quotations to-day were: Call, 2¼@2¾ per cent; sixty days, 3¼@4 per cent.

Other Markets

In Philadelphia the most significant feature was the initial dividend of 1 per cent on Lehigh Valley Transit preferred. This declaration was followed by an advance in the preferred to 22¼. The common remained quiescent.

The Boston market has been irregular. Massachusetts Electric has been the only feature in tractions.

In Baltimore the first mortgage 4s of the United Railways continue strong and in demand at 85½, the funding 5s at 84¼ and the incomes at 62 and 62¾. The 5 per cent three-year notes are quoted at 99 and interest.

Quotations of traction and manufacturing securities follow:

	Sept. 26.	Sept. 30.
American Light & Traction Company (common)	a290	a295
American Light & Traction Company (preferred)	a106	a107
American Railways Company	a44	a44
Aurora, Elgin & Chicago Railroad (common)	a42½	a43
Aurora, Elgin & Chicago Railroad (preferred)	a87	a87
Boston Elevated Railway	a125	a125
Boston Suburban Electric Companies (common)	a14	a14
Boston Suburban Electric Companies (preferred)	a75	a75
Boston & Worcester Electric Companies (common)	a12	a10½
Boston & Worcester Electric Companies (preferred)	a51	a51
Brooklyn Rapid Transit Company	a72⅝	a74⅛
Brooklyn Rapid Transit Company, 1st ref. conv. 4s	83	*83
Capital Traction Company, Washington	a130	a128
Chicago City Railway	a180	a180
Chicago & Oak Park Elevated Railroad (common)	a3	3
Chicago & Oak Park Elevated Railroad (preferred)	a6	6
Chicago Railways, ptcptg., ctf. 1	a95	a95
Chicago Railways, ptcptg., ctf. 2	a27	a27¼
Chicago Railways, ptcptg., ctf. 3	a10	a10
Chicago Railways, ptcptg., ctf. 4	a6½	a6⅜
Cincinnati Street Railway	*132	a131½
Cleveland Railway	a99½	a100
Columbus Railway (common)	*83	83
Consolidated Traction of New Jersey	a75	a75½
Consolidated Traction of N. J., 5 per cent bonds	a104	a104
Dayton Street Railway (common)	a25	a25
Dayton Street Railway (preferred)	a101	a101
Detroit United Railway	a70	a70
General Electric Company	146	149½
Georgia Railway & Electric Company (common)	a158	a162
Georgia Railway & Electric Company (preferred)	a93	a93
Interborough Metropolitan Company (common)	13⅝	21⅛
Interborough Metropolitan Company (preferred)	40⅜	57
Interborough Metropolitan Company (4½s)	77½	77½
Kansas City Railway & Light Company (common)	a19	a19
Kansas City Railway & Light Company (preferred)	a42	a45
Manhattan Railway	132	135½
Massachusetts Electric Companies (common)	a17	a19
Massachusetts Electric Companies (preferred)	a87¼	a89
Metropolitan West Side, Chicago (common)	*27	*27
Metropolitan West Side, Chicago (preferred)	*75	*75
Metropolitan Street Railway, New York	*15	a8
Milwaukee Electric Railway & Light (preferred)	*110	110
North American Company	65	65
Northern Ohio Light & Traction Company	*57	a57
Northwestern Elevated Railroad (common)	*30	*30
Northwestern Elevated Railroad (preferred)	*70	*70
Philadelphia Company, Pittsburgh (common)	49	a50
Philadelphia Company, Pittsburgh (preferred)	42	a42¼
Philadelphia Rapid Transit Company	21	a20⅞
Philadelphia Traction Company	83	a83
Public Service Corporation, 5% col. notes (1913)	*94	94
Public Service Corporation, ctfs.	a103	a103½
Seattle Electric Company (common)	a110	a110
Seattle Electric Company (preferred)	a100	100
South Side Elevated Railroad (Chicago)	a95½	a95½
Third Avenue Railroad, New York	7⅜	8
Toledo Railway & Light Company	6½	6½
Twin City Rapid Transit, Minneapolis (common)	*106¾	a106½
Union Traction Company, Philadelphia	48¾	a49¼
United Ry. & Electric Company (Baltimore)	*17¾	18
United Rys. Inv. Co. (common)	29	31
United Rys. Inv. Co. (preferred)	53½	56
Washington Ry. & Electric Company (common)	a41	a40
Washington Ry. & Electric Company (preferred)	a89	a89
West End Street Railway, Boston (common)	a85½	a85½
West End Street Railway, Boston (preferred)	a100½	a100¼
Westinghouse Elec. & Mfg. Co.	60¾	62
Westinghouse Elec. & Mfg. Co. (1st pref.)	a118	a111½

aAsked. *Last sale.

ANNUAL REPORT

American Railways Company

Gross earnings of the subsidiary companies of the American Railways Company, of Philadelphia, excluding the Johnstown (Pa.) Traction Company, were $4,049,188 in the year ended June 30, 1911, a gain of $243,765, or 6.51 per cent, over the previous year. The report of the American Railways Company, whose income is received chiefly from subsidiary companies, compares as follows with the two preceding years:

Year ended June 30.	1911.	1910.	1909.
Gross income	$810,413	$693,678	$527,114
Expenses, taxes, interest, etc	387,926	340,385	216,385
Net income	$422,487	$353,293	$310,729
Dividends	381,786	342,072	305,706
Surplus	$40,701	$11,221	$5,023

J. J. Sullivan, president, says in part in the report:

"The total number of passengers carried was 86,675,437, showing an increase of 10,103,331, at the rate of 13¼ per cent.

"After paying all operating expenses, fixed charges, interest and taxes (including the new United States government tax, amounting to $7,839), we have spent during the year 18 per cent of the gross earnings in maintenance of way and structures and maintenance of equipment, in order to keep the properties up to the highest standard. In addition to the regular charges for depreciation a special appropriation of $39,909 was made to this fund, leaving the amount to the credit of the depreciation reserve account of the subsidiary companies $529,551.

"The net income of the American Railways Company amounted to $422,487, out of which was paid 6 per cent dividend on $6,363,150, amounting to $381,786, leaving a surplus of $40,701, which, added to our previous surplus, makes that amount $554,187.

"The credit of our fire insurance fund has been increased during the year in the sum of $31,171, making the amount in that fund $231,247.

"The accident insurance fund shows a credit of $33,237, a gain for the year of $2,250, with the claims pending somewhat below normal.

"During the year the company bought the control of the Ohio Valley Electric Railway, acquiring about 99 per cent of its capital stock. That company owns the street railways and operates the same from Guyandotte, W. Va., to Huntington, W. Va., in and through Huntington to Ceredo and Kenova, W. Va., to Catlettsburg and Ashland, Ky., and from Coal Grove to Ironton and to Hanging Rock, Ohio. The purchase includes the control of all of the capital stock of the Consolidated Light & Railway Company in all of the West Virginia towns, the Ashland Electric Light & Power Company and the Ironton Electric Company, which does all the lighting from Coal Grove to Hanging Rock, Ohio.

"We also purchased the electric light plant at Bellwood, Blair County, Pa., and consolidated it with the Home Electric Light & Steam Heating Company, of Tyrone, Pa."

In his comments on the affairs of the subsidiary companies Mr. Sullivan says in part:

"Altoona & Logan Valley Electric Railway, Altoona, Pa.—During the year the gross earnings increased $45,506. The wages of our employees were increased $10,000. A new Columbia car hoist has been bought for the repair shop; also an armature winding machine and a device for removal and replacement of steel tires.

"Home Electric Light & Steam Heating Company, Tyrone, Pa.—This company shows an increase in gross receipts of about 20 per cent. During the year several extensions were made to accommodate the public demand for lighting.

"Chicago & Joliet Electric Railway Company.—For the year the gross receipts were $482,490, showing a decrease of $5,306. The light and power lines were extended in Argo and Summit. Two new double-truck and four single-truck cars were purchased; also one new sprinkler and snow plow. One combination flat and gondola car and five second-hand cars were added to the equipment. Sixty-nine battery tanks were replaced, the repair shop was enlarged, a new wheel lathe, armature bander, 26-in. drill press, power hack saw and portable floor crane were added to the shop equipment.

"Scranton (Pa.) Railway Company.—The gross earnings increased $64,862. On the Moosic Lake Railroad 9 miles of track were rebuilt, longer sidings installed, track bonded, trolley poles and wire erected and operation begun in May, 1911. Ten new steel double-truck cars with motors were bought. A new double-truck work car was built and a new express car is nearly completed; 186 automotoneers were installed. A new coal conveyor was purchased. New substation cars were placed on the Moosic line. Thirty cars were overhauled and made practically as good as new.

"The People's Railway, Dayton, Ohio.—The gross income increased during the year $21,027. Five new single-truck pay-within cars were bought and are in use. Ten double-truck cars are being built.

"The Springfield (Ohio) Railway.—Gross earnings increased $18,278. On account of the city doing a large amount of street paving, we were obliged to rebuild our tracks, using new 6-in. rail on steel ties in concrete and new brick paving.

"Roanoke (Va.) Railway & Electric Company.—During the year the gross earnings increased $61,728. New double track was built to the park and track relocated. A new work car and a new snow sweeper were bought. A number of automotoneers were installed. The tailrace was improved and coal trestle rebuilt. A motor-driven pump was installed. At Mountain Park a keeper's cottage was erected and the skating rink was rebuilt.

"Lynchburg (Va.) Traction & Light Company.—The gross earnings increased $20,038. During the year an extension was built to Fairview Heights.

"Bridgeton & Millville Traction Company, Bridgeton, N. J.—The gross earnings increased $5,718.

"Bridgeton (N. J.) Electric Company.—During the year a determined effort was made to increase the business, which met with considerable success. The gross earnings increased $9,042. Several line extensions were made to reach the new customers; also a good many power customers were obtained. This feature of the business is likely to have much more growth in the future.

"The purchase of the Ohio Valley Electric Railway has added to our car equipment fifty-six cars; with thirty-six new cars bought during the year we have on the different roads owned by the company a total of 784 cars and 415.4 miles of track.

"All of the properties are in a satisfactory condition."

Georgia Railway & Power Company

The Georgia Railway & Power Company, Atlanta, Ga., the incorporation of which was noted briefly in the Electric Railway Journal of Sept. 23, 1911, will lease the property of the Georgia Railway & Electric Company and the Georgia Power Company and has contracted to purchase outright the property of the Atlanta Water & Electric Power Company. As previously stated, the company will be capitalized at $27,000,000, of which $15,000,000 will be common stock, $2,000,000 first preferred stock and $10,000,000 second preferred 4 per cent non-cumulative stock. The terms on which the leases will be arranged have not been announced, but J. J. Spalding, Atlanta, one of the incorporators of the new company, has issued a statement in regard to the purpose of the company, in which he says in part:

'The Georgia Railway & Power Company was formed to acquire the water-power properties of the Georgia Power Company, the Atlanta Water & Electric Power Company, and to acquire by lease the Georgia Railway & Electric Company, and especially to construct and operate in connection with the development of these water powers a system of interurban electric railways. The first of these lines will be run from Stone Mountain to Decatur.

"By leasing the Georgia Railway & Electric Company the new company will acquire the supplemental steam plants situated in Atlanta, which will enable it to double the capacity of the water-power development by supplementing it in dry weather, and also enable the new company to protect all of the towns and cities which it reaches with lines in case of accident or emergency.

"All of the money furnished is coming from Canadian and English sources. The new company will be organized under Georgia law and all of its properties will be subject to taxation in Georgia. The lease of the Georgia Railway & Electric Company will guarantee its present dividend, payable quarterly, and also all of its indebtedness."

Bristol (Tenn.) Belt Line Railway.—The Bristol Belt Line Railway has filed with the Secretary of State of Tennessee an amendment to its charter, changing the name to Bristol Traction Company and increasing the capital stock from $100,000 to $300,000.

California Midland Railroad, San Francisco, Cal.—The California Midland Railroad recently placed through the Rideout Bank and A. C. Irwin, Marysville, Cal., at 90 and interest, $1,800,000 of first mortgage 5 per cent sinking fund forty-year gold bonds to provide funds to complete the road from Marysville to Grass Valley and to pay for acquired lines, which include the Nevada County Narrow Gage Railroad, operating between Colfax and Nevada City, 20½ miles, and the Marysville Traction Company. The bonds are dated May 1, 1907, and are due on May 1, 1947, but are callable on or after March 31, 1917. The Mercantile Trust Company, San Francisco, Cal., is trustee of the issue.

Dallas (Tex.) Electric Corporation.—The Dallas Electric Corporation has declared a dividend of 3 per cent on the $2,000,000 of present 5 per cent non-cumulative second preferred stock, payable on Oct. 9, 1911. This compares with 2 per cent paid in April, 1911, and 1 per cent in October, 1910.

Lake Erie, Bowling Green & Napoleon Railway, Bowling Green, Ohio.—The receivers of the Lake Erie, Bowling Green & Napoleon Railway have been authorized by Judge Killits, of the federal court, to expend $50,000 for improvements to the hot water heating and electric light plants at Bowling Green, Ohio.

Lehigh Valley Transit Company, Allentown, Pa.—The Lehigh Valley Transit Company has declared an initial dividend of 1 per cent on the $4,979,687 of 5 per cent preferred stock, payable on Nov. 10, 1911. The dividend on this stock is cumulative after Nov. 3, 1910.

Metropolitan Street Railway, Kansas City, Mo.—The receivers of the Metropolitan Street Railway report as follows for the three months ended Aug. 31, 1911: Passenger earnings, $1,442,094, an increase of $23,401 over the same period of 1910; total disbursements, $1,422,278.

Republic Railway & Light Company, New York, N. Y.—The Republic Railway & Light Company has declared an initial quarterly dividend of 1½ per cent on the $5,200,000 of 6 per cent cumulative preferred stock, payable on Oct. 16, 1911.

Salt Lake & Ogden Railway, Salt Lake City, Utah.—The Harris Trust & Savings Bank, Chicago, Ill., Harris Forbes & Company, New York, and N. W. Harris & Company, Inc., Boston, are placing $75,000 of first mortgage 5 per cent gold bonds of the Salt Lake & Ogden Railway, dated 1909, due Feb. 1, 1934, but callable at 105 and interest on and after Feb. 1, 1914.

Sao Paulo Tramway, Light & Power Company, Sao Paulo, Brazil.—It is announced that the Sao Paulo Tramway, Light & Power Company has arranged to dispose of £150,000 additional perpetual consolidated debenture stock.

Second Avenue Railroad, New York, N. Y.—Supreme Court Justice Bijur has given permission to George W. Linch, receiver of the Second Avenue Railroad, to issue $3,065,000 of receivers' certificates to meet an issue of receivers' certificates for $3,000,000 due on Oct. 1. The entire issue will amount to $3,200,000, the remaining $135,000 being held for emergency.

Springfield & Xenia Railway, Springfield, Ohio.—The Springfield & Xenia Railway has declared a dividend of 1½ per cent on the $300,000 of 5 per cent cumulative preferred stock, payable on Sept. 30, 1911. This compares with 1¼ per cent in July and April, 1910, and 1¾ per cent in January, 1911.

Virginia Railway & Power Company, Richmond, Va.—The Virginia Railway & Power Company has declared an initial semi-annual dividend of 1 per cent on the $7,450,500 of common stock, payable on Oct. 20, 1911.

Youngstown & Ohio River Railroad, Leetonia, Ohio.—The Youngstown & Ohio River Railroad has declared a quarterly dividend of 1 per cent on the $1,000,000 of 5 per cent preferred stock, payable on Sept. 30, 1911. This compares with ¾ of 1 per cent paid quarterly from October, 1910, to July, 1911.

Dividends Declared

Auburn & Syracuse Electric Railroad, Syracuse, N. Y., quarterly, 1½ per cent, preferred.

Boston (Mass.) Suburban Electric Companies, quarterly, $1, preferred.

Central Pennsylvania Traction Company, Harrisburg, Pa., $3.

Cincinnati, Newport & Covington Light & Traction Company, Covington, Ky., quarterly, 1⅛, preferred; quarterly, 1¼, common.

Ft. Smith Light & Traction Company, Ft. Smith, Ark., quarterly, 1¾ per cent, preferred.

Honolulu Rapid Transit & Land Company, Honolulu, Hawaii, quarterly, 1½ per cent, common.

Kokomo, Marion & Western Traction Company, Kokomo, Ind., 3 per cent, preferred.

Manchester Traction, Light & Power Company, Manchester, N. H., quarterly, 2 per cent.

Memphis (Tenn.) Street Railway, quarterly, 1¼ per cent, preferred.

Nashville Railway & Light Company, Nashville, Tenn., quarterly, 1¼ per cent; quarterly, 1 per cent, common.

Ottumwa Railway & Light Company, Ottumwa, Ia., quarterly, 1¾ per cent, preferred.

Syracuse (N. Y.) Rapid Transit Company, quarterly, 1½ per cent, preferred; 1 per cent, common.

Utica & Mohawk Valley Railway, Utica, N. Y., quarterly, 1¼ per cent, preferred; quarterly, 1 per cent, common.

Western Ohio Railway, Lima, Ohio, quarterly, 1½ per cent, second preferred; quarterly, 1¼ per cent, first preferred.

Wheeling (W. Va.) Traction Company, quarterly, 1 per cent.

MONTHLY ELECTRIC RAILWAY EARNINGS

AURORA, ELGIN & CHICAGO RAILROAD COMPANY.

Period.			Gross Revenue.	Operating Expenses.	Net Revenue.	Fixed Charges.	Net Income.
1 m.,	Aug.	'11.....	$189,282	$92,749	$96,533	$36,444	$60,089
1 "	"	'10.....	178,730	87,477	91,254	33,039	58,215
2 "	"	'11.....	375,553	184,286	191,266	72,919	118,348
2 "	"	'10.....	361,118	175,089	186,029	65,608	120,421

MONTREAL STREET RAILWAY.

1 m.,	Aug.	'11.....	$443,108	$232,530	$210,578	$73,634	$136,945
1 "	"	'10.....	398,829	216,314	182,514	65,743	116,771
11 "	"	'11.....	4,319,819	2,478,725	1,841,094	549,607	1,291,488
11 "	"	'10.....	3,889,475	2,237,830	1,651,645	485,290	1,166,355

NORTHERN TEXAS ELECTRIC COMPANY.

1 m.,	July,	'11.....	$131,383	$66,878	$65,505	$25,592	$38,913
1 "	"	'10.....	125,943	68,147	57,796	20,273	37,523
12 "	"	'11.....	1,545,631	803,959	741,672	276,604	464,769
12 "	"	'10.....	1,367,246	737,475	629,771	218,299	411,472

PADUCAH TRACTION & LIGHT COMPANY.

1 m.,	July,	'11.....	$22,477	$12,559	$9,918	$7,842	$2,079
1 "	"	'10.....	21,577	11,697	9,880	7,023	2,857
12 "	"	'11.....	257,760	141,453	116,307	91,523	24,785
12 "	"	'10.....	240,492	143,406	97,086	82,411	14,675

PUGET SOUND ELECTRIC RAILWAY.

1m.,	July,	'11.....	$163,774	$92,832	$70,941	$50,818	$20,123
1 "	"	'10.....	182,986	102,204	80,782	51,292	29,491
12 "	"	'11.....	1,828,195	1,230,329	597,866	602,820	4,955
12 "	"	'10.....	1,943,290	1,280,796	662,494	599,315	63,178

SAVANNAH ELECTRIC COMPANY.

1 m.,	July,	'11.....	$64,039	$45,482	$18,556	$18,358	$199
1 "	"	'10.....	59,140	40,942	18,198	18,193	5
12 "	"	'11.....	666,946	447,124	219,822	218,444	1,378
12 "	"	'10.....	615,165	401,655	213,510	213,193	317

SEATTLE ELECTRIC COMPANY.

1 m.,	July,	'11.....	$467,869	$247,595	$220,275	$115,681	$104,593
1 "	"	'10.....	459,059	261,509	197,550	110,108	87,175
12 "	"	'11.....	5,560,422	3,090,276	2,470,146	2,432,001	1,130,153
12 "	"	'10.....	5,852,062	3,420,061	1,339,993	1,287,517	1,144,485

TAMPA ELECTRIC COMPANY.

1 m.,	July,	'11.....	$57,253	$29,450	$27,803	$6,930	$20,873
1 "	"	'10.....	51,506	28,900	22,607	6,711	15,895
12 "	"	'11.....	621,111	327,588	293,523	76,827	216,696
12 "	"	'10.....	619,517	349,716	269,800	57,310	212,491

TOLEDO RAILWAYS & LIGHT COMPANY.

1 m.,	Aug.	'11.....	$252,534	$156,738	$95,795	$79,158	$16,637
8 "	"	'11.....	2,041,174	1,275,387	765,787	633,539	132,248

Traffic and Transportation

New Orleans Company Issues Pamphlet of Suggestions for the Prevention of Accidents

Under the direction of D. A. Hegarty, manager of the railways, operating and electric departments of the New Orleans Railways & Light Company, New Orleans, La., the company has prepared a four-page pamphlet, "Important Suggestions—How to Avoid Accidents," copies of which are being sent to all the schools in that city so that teachers can distribute them to pupils. Under the heading "Caution" there appears this advice in a series of "don'ts";

"Don't cross the street when a car is coming within the square.

"Don't roller skate on streets where there are car tracks.

"Don't play ball on streets where there are car tracks.

"Don't get on or off a car until it stops.

"Don't ride on the rear platform of a car. This is dangerous.

"Don't touch any loose wire that you see in the street. It may be charged and hurt you.

"Don't send your little brother or sister across the street to buy candy.

"Don't forget the instructions of your teacher and parents.

"Don't jump or hang on any wagon or other vehicle on the street. This is extremely dangerous.

"Don't cross any street until you first ascertain if any fast vehicles are approaching.

"Don't get off a car backwards. Always face the front end.

"Don't cross the street directly behind a car. You are liable to be run over by a car going in the opposite direction.

"Don't throw rocks or brickbats at a car. You are liable to injure someone.

"Don't tease irresponsible persons on the street. They may throw at you and cause you to run in front of a car at the risk of your life.

"Don't roller skate behind vehicles by holding on to same This is very dangerous.

"Don't hitch the rope of your cart or wagon to any car or other vehicle when you ride in the street.

"Don't hold on to cars or wagons when you are riding a bicycle. This is very dangerous.

"Don't come suddenly into streets that cross car tracks with your wagon or cart while playing in the street; and don't ride it in streets on which street cars run."

Under the heading "Things Children Should Do" appears this advice:

"Tell your playmates to be careful when crossing a street and look out for all kinds of vehicles.

"Tell your mother and sisters to wait until a car comes to a full stop before getting off or on.

"Tell your mother and sisters always to get off a car facing the front end.

"Tell your playmates that you will not play ball or roller skate in streets where there are car tracks. It is dangerous.

"Tell your playmates to keep away from all wires that they see hanging in the street.

"If you see a wire in the street emitting sparks or flashes, get away. It is very dangerous, especially in damp weather.

"Always hold to your mother's hand when crossing a street with her."

Fenders Ordered in Centralia, Ill.—The City Council of Centralia, Ill., has passed an ordinance directing the Centralia & Central City Traction Company to equip its cars with fenders.

Dayton Companies Arrange to Interchange Tickets.—The People's Railway and the Dayton Street Railway of Dayton, Ohio have arranged to interchange tickets as an accommodation to the people who use both lines.

Car Plunges Into Canal.—A car of the Trenton & Mercer County Traction Corporation, Trenton, N. J., plunged through an open draw at Trenton, N. J., on Sept. 21, 1911, and into the Delaware & Raritan Canal. None of the passengers were seriously injured.

Fare Between Birmingham and Ensley.—A. O. Lane conferred recently with A. H. Ford, president of the Birmingham Railway, Light & Power Company, Birmingham, Ala., in reference to the 5-cent carfare between Ensley and Birmingham. Commissioner Lane said after the conference that some action might certainly be expected in the immediate future.

Local Service Between Albany and Schenectady.—The Public Service Commission of the Second District of New York made an order requiring the Schenectady (N. Y.) Railway to change the schedule upon which its local cars are now running between Schenectady and Albany during the hours in which limited cars are operated, so that the local cars will leave Albany and Schenectady terminals fifteen and forty-five minutes after each hour. The arrangement which is provided for in the order was agreed upon after conferences held between Electric Railroad Inspector Barnes of the commission and E. F. Peck, general manager of the Schenectady Railway.

Milwaukee Electric Railway & Light Company Folder.—The Milwaukee Electric Railway & Light Company, Milwaukee, Wis., in its latest timetable folder, which consists of sixteen pages and cover, presents the timetables, rates of fare and descriptions of towns along the interurban lines, and short essays which should help to educate the public to a better understanding of the company's position in the community which it serves. These educational articles are: "Misunderstanding and Prejudice," "The Streets Belong to the People," "Franchises, What Are They?" 'How the Street Railway Helps the City's Growth," "Increased Cost of Street Railway Operation," "Insufficiency of Present Street Railway Fares," "Good Street Railway Service and What It Means." The cover of the new folder shows a map of the interurban system and a view of one end of the large Public Service Building and Terminal at Milwaukee.

Bridge Traffic in New York.—The bridge commissioner of New York reports that for the last quarter the cars of the Gates Avenue line of the Brooklyn Rapid Transit Company made 31,810 trips over the Brooklyn Bridge, the cars of the Graham Avenue line 29,517 trips, and the cars of the Court Street, Putnam Avenue, Fulton Street and Bergen Street lines more than 20,000 trips. The cars of the DeKalb Avenue and the Smith Street lines of the Coney Island & Brooklyn Railroad made more than 20,000 trips. The Fulton Street elevated line made 71,234 trips; the Lexington Avenue elevated line, 62,033 trips; Myrtle Avenue elevated, 55,086; Brighton Beach elevated, 53,270; Fifth Avenue elevated, 45,235; West End elevated, 36,719. All of these elevated lines are operated by the Brooklyn Rapid Transit Company. The largest number of trips over the Williamsburg Bridge was made by the Ralph Avenue line of the Brooklyn Rapid Transit Company. The surface car tolls over the Brooklyn Bridge for the quarter were $18,736.50 and the elevated tolls $35,530.70. The surface car tolls over the Williamsburg Bridge amounted to $21,078.65 and the elevated tolls to $8,681.80.

Permission Granted for Removal of Third Track.—The Public Service Commission of the Second District of New York has given the International Railway, Buffalo, N. Y., permission to take up its third track on the east side of Main Street between Eagle Street and North Division Street, Buffalo. The line is now used for the operation of the William Street and Clinton Street cars through Main Street. The company is also permitted to remove the curves connecting the track in question with the track in Eagle Street and the track in North Division Street. The company now proposes to make the turn of the Clinton Street and William Street cars by taking them through Washington Street from North Division Street to Eagle Street. At the hearing there was considerable opposition to the removal of the tracks, the principal objection raised being the inconvenience to patrons of the William Street and Clinton Street lines in making transfers to west side lines. The company showed that the block in question on Main Street was one of the busiest in the city and was very much congested during the rush hours of the day; that the third track interfered with vehicular and pedestrian traffic, and that in seventeen months and twenty days ending in September eighty-eight accidents had happened on this block, due largely to the existence of the third track in the street.

Personal Mention

Mr. Clyde Russell has resigned as master mechanic of the Elgin & Belvidere Electric Company, Chicago, Ill.

Mr. J. A. Wilcox has been appointed master mechanic of the Corning & Painted Post Street Railway, Corning, N. Y.

Mr. J. A. Dorman has been appointed dispatcher and accountant of the Elmira, Corning & Waverly Railway, Waverly, N. Y., and the Corning & Painted Post Street Railway.

Mr. J. B. Stewart, Jr., has been appointed superintendent and assistant engineer of the Elmira, Corning & Waverly Railway, Waverly, N. Y., and the Corning & Painted Post Street Railway.

Mr. W. H. Burke, formerly purchasing agent of the Illinois Traction System, has been placed in charge of the wholesale and retail coal selling and delivery business of the McKinley properties at St. Louis, Mo.

Mr. A. M. Campbell, formerly assistant storekeeper of the Atchison, Topeka & Santa Fé Railway at Topeka, Kan., has been appointed storekeeper of the Illinois Traction System, with headquarters at Decatur.

Mr. R. M. Howard has been appointed general manager of the Winona Railway & Light Company, Winona, Minn., to succeed Mr. F. H. Plaice, whose resignation was announced in the Electric Railway Journal of Sept. 23, 1911.

Mr. F. E. Fisher, superintendent of construction of the Chicago, Ottawa & Peoria Railway, has been appointed general superintendent of that property, vice Mr. H. J. Vance, appointed purchasing agent for all the McKinley properties. Mr. Fisher was formerly an official of the Joliet & Southern Company.

Mr. J. C. Bacon, whose appointment as general superintendent of the Augusta Railway & Electric Company, Augusta, Ga., was noted in the Electric Railway Journal of Sept. 2, 1911, has assumed his duties with that company. Mr. Bacon was formerly connected with the Metropolitan Street Railway, Kansas City, Mo.

Mr. D. C. Hintsdorff has resigned as assistant superintendent of the Elgin & Belvidere Electric Company, Chicago, Ill., to become superintendent of the Waukegan, Rockford & Elgin Traction Company, Waukegan, Ill., which has just begun to operate between Wauconda and Palatine. Mr. Hintsdorff was formerly connected with the Chicago & Milwaukee Electric Railroad.

Mr. Llewellyn H. McLain, one of the inspectors of the Railroad Commission of Massachusetts, is soon to go West and sudy the construction, equipment and operation of electric railways in Montreal, Toronto, Syracuse, Buffalo and Albany, observing especially how the roads deal with the fender question. Mr. G. W. Bishop, of the commission, is later to make a trip South and West on a similar tour of inspection.

Mr. Henry C. Page, vice-president and general manager of the Worcester (Mass.) Consolidated Street Railway, entertained as his guests recently the members of the Lynn & Boston Street Railway Veterans' Association. Mr. Page began his street railway career with the Lynn & Boston Street Railway more than twenty-five years ago, and is vice-president of the Lynn & Boston Street Railway Veterans' Association.

Mr. H. J. Vance has resigned as general superintendent of the Chicago, Ottawa & Peoria Railway and been appointed purchasing agent for the Illinois Traction System and the Western Railways & Light Company. The latter corporation owns among other properties the one which Mr. Vance has operated for the last three years. Mr. Vance succeeds Mr. W. H. Burke as purchasing agent. The office of the purchasing agent has been removed from Decatur to Peoria, Ill.

Mr. David E. Pepin has resigned as superintendent of the Ware & Brookfield Street Railway, Ware, Mass., to go to Seattle. Mr. Pepin was born in Minneapolis. He became connected with the Hampshire & Worcester Street Railway, the predecessor of the Ware & Brookfield Street Railway, in 1900 during construction and when the road was placed in operation in 1901 he was appointed superintendent and has continued in that capacity since that time.

Mr. Calvert Townley has been elected president of the Lackawanna & Wyoming Valley Rapid Transit Company, Scranton, Pa., and its subsidiary companies to succeed Mr. George C. Smith, who is leaving the Westinghouse interests to devote his time to affairs of his own. Mr. Townley, as assistant to the president of the Westinghouse Electric & Manufacturing Company, represents directly the control by that company of the Lackawanna & Wyoming Valley Rapid Transit Company.

Mr. J. D. Evans has been appointed supervising engineer and superintendent of construction for the Montreal (Que.) Street Railway. Mr. Evans is also resident engineer for J. G. White & Company, Inc., on the Canadian Light & Power Company's works. Mr. Evans has had charge of engineering and construction work in Canada, the United States and the South American republics. Prior to going to Montreal he had charge of the engineering and construction work of the Buffalo, Lockport & Rochester Railway.

Mr. Alfred Craven has been appointed chief engineer of the Public Service Commission of the First District of New York in charge of rapid transit construction. Mr. Craven has been acting as chief engineer ever since the resignation of Mr. Henry B. Seaman a year ago. Mr. Craven is a son of Rear-Admiral Craven of the United States Navy and is himself a graduate of Annapolis, class of 1867. In 1884 he was appointed on the staff of the old Aqueduct Commission which built the Croton water system for New York City. In 1900 he became a division engineer of the old Rapid Transit Commission of New York, and subsequently succeeded Mr. George S. Rice as engineer in charge of subway construction.

OBITUARY

N. B. McPherson, auditor of the Toledo & Chicago Interurban Railway, Kendallville, Ind., is dead.

NEW PUBLICATIONS

Straight Line Engineering Diagrams. Compiled by Manifold & Poole, engineers, Los Angeles, Cal. Published by the Technical Publishing Company, San Francisco, Cal. Cloth, 44 diagrams. Price, $3.

This book contains a number of computing diagrams, giving rapid, approximate solutions of the common problems in the design and construction of electric systems and similar undertakings. These include the diagrams to be used in the design of foundations, arches and reinforced concrete walls, reducing stadia readings to linear dimensions, calculations of the capacity of pipes and flumes, the horse-power of engines and the power transmitted by shafting, gearing and belting calculated. Electric distribution problems are also worked out with suitable diagrams.

Electric Traction for Railway Trains. By Edward P. Burch. McGraw-Hill Book Company. New York, 1911. 583 pages; illustrated. Price, $5.

This is the most complete treatise yet published on the subject of heavy electric traction and has been prepared especially for students, electrical and mechanical engineers and superintendents of motive power. The substance of the work was delivered by the author in a series of lectures during the last four years to the senior students of electrical engineering at the University of Minnesota. The first part of the book is very largely a record of what has been accomplished in this country and abroad, to which Mr. Burch has added a critical comparison of the results obtained with different electrical systems and with steam locomotives operating under different conditions. Tables of performance and copious references to the technical press at home and abroad make these chapters most valuable as a handbook to an engineer in charge of work of this kind. The author then discusses the procedure to be followed in undertaking a problem of steam railroad electrification and adds tabulated statistics of the costs of different existing and proposed installations. The concluding chapter is a summary of the work done in railroad electrification. The book is accompanied by a comprehensive index.

Construction News

Construction News Notes are classified under each heading alphabetically by States.

An asterisk (*) indicates a project not previously reported.

RECENT INCORPORATIONS

***Mobile Interurban Motor Railway, Mobile, Ala.**—Application for a charter has been made by this company in Alabama to build a 2-mile line from the terminus of the Spring Hill line of the Mobile Light & Railway Company to the Pinehurst subdivision. Capital stock, $25,000. Incorporators: C. C. Meecham, Mobile; J. J. Dowling, Steubenville, Ohio; J. D. Atkins, A. H. Brinkman. [E. R. J., Feb. 11, '11.]

Eastern Indiana Traction Company, Richmond, Ind.—Application for a charter has been made in Indiana by this company to build an electric railway between Richmond and Portland, via Liberty, Brookville and Harrison, Ohio. Capital stock, $50,000. Officers: Sharon E. Jones, president; Adam H. Bartel, vice-president, and Charles W. Jordan, secretary and treasurer. [E. R. J., April 1, '11.]

***Oklahoma Northwestern Railway, Oklahoma City, Okla.**—Chartered in Oklahoma to build a railway from Oklahoma City to Woodward, via the Counties of Oklahoma, Canadian, Kingfisher, Blaine, Dewey and Woodward. It is the intention to build a branch from the North Canadian River near Canton to Seiling Cestos and Mutual. About 30 miles of surveys have been completed. Capital stock, $100,000. E. A. Wagener, Oklahoma City, president.

FRANCHISES

***Tuscaloosa, Ala.**—F. G. Blair and Henry B. Foster have asked the City Council for a franchise in Tuscaloosa.

Texarkana, Ark.—The Texarkana Gas & Electric Company, Texarkana, has received a franchise from the City Council to double track its East Side line in Texarkana.

Los Angeles, Cal.—The Board of Supervisors passed an ordinance authorizing the sale on Oct. 2, 1911, of a forty-year franchise to build an elevated electric railroad over El Monte Road.

San José, Cal.—C. P. Anderson has asked the County Board of Supervisors for a franchise to build an 11-mile electric or gas-electric railway from San José to New Almaden. [E. R. J., Sept. 16, '11.]

***San Francisco, Cal.**—Paul B. Fay has received a franchise from the Supervisors to build a double-track electric railway on Bryant Street to connect the existing tracks on Army Street and Twenty-sixth Street. The line will be operated by the United Railroads.

Woodland, Cal.—The Sacramento Valley West Side Electric Railway will apply for a franchise through Yola, Colusa, Glenn & Tehama Counties. [E. R. J., Aug. 19, '11.]

North Haven, Conn.—The Connecticut Company has asked the Common Council for approval of proposed method of construction of a double-track line in North Haven and Hamden, on Whitney Avenue, from Lake Whitney to the Mount Carmel railroad station. The company will also ask for a franchise in North Canaan.

Stamford, Conn.—The New York & Stamford Railway, Port Chester, has asked the Borough Board for a franchise to double track its Putnam Avenue line from Greenwich Avenue to Pit's Hill in Stamford.

Pueblo, Col.—The Pueblo & Suburban Traction & Lighting Company has received a twenty-five-year extension of its franchise from the City Council in Pueblo.

East St. Louis, Ill.—The Southern Railway has received a franchise from the City Council to build a second track to its belt line around the southern half of East St. Louis.

Gary, Ind.—The Indianapolis, Chicago & Meridian Railway, Indianapolis, has asked the City Council for a franchise in Gary. This railway will connect Indianapolis, Sheridan, Flora, Gary, Monticello, Hammond and Warsaw. M. J. Mooreland, secretary. The company also asked the Marion County Commissioners for a franchise through Marion County. [E. R. J., July 15, '11.]

Indianapolis, Ind.—The Indianapolis & Delphi Traction Company has received a fifty-year franchise from the County Commissioners to build an interurban electric railway between Forty-second Street, Indianapolis, and the Hamilton-Marion County line. [E. R. J., April 15, '11.]

Hagerstown, Md.—The Hagerstown & Clearspring Railway has received a franchise from the Washington County Commissioners to build over various county roads in Maryland to the Pennsylvania State line. L. N. Downs, Hagerstown, president. ([E. R. J., Sept. 16, '11.]

Montague, Mass.—The Miller's River Street Railway, Miller's Falls, has received a franchise from the Town Council in Montague. This line will connect Miller's Falls, Montague, Irving, Wendal and Orange. [E. R. J., Sept. 2, '11.]

Revere, Mass.—The Boston & Eastern Railway, Boston, has asked the City Council for a franchise in Revere. This line will connect Boston, Beverly, Danvers, Lynn, Chelsea, Revere, Salem and Swampscott. [E. R. J., Sept. 16, '11.]

Duluth, Minn.—The Duluth Street Railway has asked the City Council for a franchise in Duluth from Raleigh Street to the bay.

Virginia, Minn.—W. M. Prindle and W. M. Prindle, representing the Virginia, Eveleth & Gilbert Traction Company, Duluth, have received a franchise from the City Council in Virginia. The line will connect Virginia, Eveleth and Gilbert. [E. R. J., April 1, '11.]

***Laurel, Miss.**—P. H. Saunders and S. M. Jones have received a twenty-five-year franchise from the City Council to build a 3-mile electric railway over the principal streets in Laurel.

St. Joseph, Mo.—The Kansas City, Clay County & St. Joseph Railway has received a franchise from the County Court to build an electric railway from St. Joseph southward across the county. [E. R. J., Sept. 16, '11.]

Newark, N. J.—The Public Utility Commission of New Jersey has approved franchise ordinances passed in favor of the Public Service Railway in Newark and Montclair.

Schenectady, N. Y.—The Schenectady Railway has received a franchise from the City Council to extend its tracks on Union Street to North Terrace and to build several lines in the northern section of Schenectady to the American Locomotive Works.

Newburg Heights, Ohio.—The Council of Newburg Heights will be asked to cede the right-of-way to that portion of land needed for the Denison and Harvard Street line extension to Newburg Heights from Cleveland.

Sapulpa, Okla.—The Union Traction Company, Tulsa, has asked the City Council for a franchise in Sapulpa.

Eugene, Ore.—The Oregon Electric Railway has received a franchise from the City Council to build a loop from Eighth Street to Ninth Street in Eugene.

Junction City, Ore.—The Oregon Electric Railway, Portland, has received a franchise from the City Council for a franchise in Junction City.

New Castle, Pa.—The New Castle, New Wilmington & Sharon Electric Railway has received a year's extension of its franchise from the Councils in which to begin the construction of its proposed 15-mile electric railway between New Castle, Bethel, Sharon, New Wilmington, Middlesex and Meadville. James Campbell is interested. [E. R. J., April 1, '11.]

Burlington, Wash.—The Bellingham-Skagit Railway has received a franchise from the City Council to build an electric railway in Burlington from north to south and to build a spur to the northwest paralleling the Great Northern Railway to Anacortes.

TRACK AND ROADWAY

Fresno, Hanford & Summit Lake Interurban Railway, Fresno, Cal.—Grading has been completed by this company and the laying of rails will begin Oct. 15.

Clear Lake Railroad, Lakeport, Cal.—The surveys being made by this company are nearly completed for its 44-mile railway from Hopeland to Lakeport. Z. T. Spencer is interested. [E. R. J., June 10, '11.]

Pacific Electric Railway, Los Angeles, Cal.—This company has awarded a contract to Robert Shearer for the construction and material required for a roadbed for a double-track line, known as the Watts-Homeward line, from a point on the Long Beach line near Watts to a point on Moneta Avenue. The company has begun extensive improvements on its lines in Whittier.

Oakland (Cal.) Traction Company.—Work has been begun by this company on its 3-mile extension from Fourteenth Avenue to Fruitvale Avenue on its Hopkins Street line in Oakland. Work will begin at once on San Pablo Avenue in Albany, which when completed will be a double-track line from Fourteenth Street and Broadway out San Pablo Avenue to the county line.

***Redlands, Cal.**—The University of Redlands and other interested parties will build a 4-mile electric railway from Redlands to the University of Redlands' grounds.

Central California Traction Company, San Francisco, Cal.—Work has been begun by this company laying double tracks on its Magnolia Avenue line.

West Side Railroad, San Francisco, Cal.—In a statement by an official of this company it is denied that the company intends at this time to build an electric railway from Sacramento to Rio Vista. The company is organized in connection with the West Sacramento Company and is to assist in developing the holdings of that company on the west side of the Sacramento River, opposite Sacramento. To do this a road 5.7 miles long will be built. [E. R. J., Sept. 9, '11.]

City & Suburban Railway, Brunswick, Ga.—Work has been begun by this company on its extension over L Street to Glynn Avenue in Brunswick.

East Rome Car Company, Rome, Ga.—This company advises that it will soon begin the construction of its 3-mile gasoline railway in Rome. Capital stock authorized, $50,000. Officers: W. E. Davies, Rome, president, and F. W. Copeland, Rome, secretary. [E. R. J., Sept. 23, '11.]

Quincy & Western Illinois Electric Railway, Quincy, Ill.—This company, which plans to build a 75-mile electric railway from Niota to Quincy, has elected the following officers: Henry Dayton, president; Henry Bastert, secretary; W. T. Duker, treasurer; David E. Mack, Carthage, Rudolph Anton, Nauvoo, C. A. Chittendon, Mendoon, and S. J. Prosser, Warsaw, vice-presidents. [E. R. J., Sept. 2, '11.]

Springfield & Northwestern Railway, Springfield, Ill.—This company has completed surveys for its projected 40-mile line from Springfield through Casey, Cantrall, Athens, Petersburgh and Greenview to Mason City. The capital for construction has not been secured as yet and no definite time has been decided upon for awarding construction contracts. Ralph N. Baker, Springfield, Ill., president. [E. R. J., Aug. 26, '11.]

Indiana Union Traction Company, Anderson, Ind.—This company is required to remove its tracks from Southerland Avenue and build an entrance into Indianapolis by way of Martinsdale Avenue or the Fair Ground. The change to either route will require an expenditure of $200,000.

Evansville & Chrisney Railway, Evansville, Ind.—This company has made arrangements to begin the construction of its line to connect Lynnville, in Warrick County, and Chrisney in Spencer County, with Evansville. Substantial subsidies have been voted in aid of constructing the line. It is the intention of the officials to let a contract for the construction in a few weeks. J. P. Chrisney is interested. [E. R. J., Aug. 26, '11.]

Gary, Hobart & Eastern Traction Company, Hobart, Ind.—Plans are being made by this company to begin at once the construction of its line between Gary and Hobart. [E. R. J., Aug. 26, '11.]

Indianapolis, Chicago & Meridian Railway, Indianapolis, Ind.—This company announces that it expects to let contracts for the construction of the road. The line will connect Indianapolis, Sheridan, Gary, Hammond and Warsaw. M. J. Mooreland, secretary. [E. R. J., July 15, '11.]

New Albany, Ind.—F. E. Segrave, Toledo, Ohio, who is promoting an electric railway from New Albany to French Lick, reports that capitalists back of him have instructed him to ask for bids and undertake the work. [E. R. J., Sept. 23, '11.]

Richmond & Eastern Indiana Traction Company, Richmond, Ind.—Sharon E. Jones, president of this company, announces that the directors will be able to finance and construct that portion of the line between Richmond and Portland this year. The line will connect Portland, Union City, Bethel, Cox's Mills, Richmond, Brookville and Harrison. A. H. Bartel is interested. [E. R. J., Sept. 23, '11.]

Vincennes, Washington & Eastern Interurban Company, Vincennes, Ind.—This company's line, which is to connect Vincennes, Wheatland, Washington and Loogootee, will be completed by the Brindley Construction Company. Work will begin Oct. 1.

***Farley, Ia.**—S. G. Durant, Omaha, Neb., and associates plan to build an electric railway between Farley, Garnaville and Luxemburg.

Ft. Dodge, Des Moines & Southern Railway, Ft. Dodge, Ia.—Plans are being made and right-of-way secured by this company for its 6-mile extension from Ankeny to Des Moines.

Iowa City (Ia.) Electric Railway.—Construction has been begun by this company on the 1½-mile extension of its line in Iowa City.

Waterloo, Cedar Falls & Northern Railway, Waterloo, Ia.—Work has been begun by this company upon a new steel bridge on the Cedar Falls line.

Kentucky Southwestern Electric Railway, Light & Power Company, Hickman, Ky.—This company will not only build an electric interurban line from Paducah toward Mayfield, Union City, Clinton and Hickman, but a belt line will be run from near Milburn, probably to Lovelaceville, thence to Blandville, to Wickliffe and from Wickliffe back to Paducah. Edward F. Wheaton, Nashville, Tenn., manager. [E. R. J., Sept. 16, '11.]

Portland, Gray & Lewiston Railway, Portland, Me.—This company has nearly completed the roadbed of its extension between Portland and Lewiston, and tracklaying will begin in a few weeks.

United Railways & Electric Company, Baltimore, Md.—This company placed in operation on Oct. 1 its new Hamburg Street extension of the Fremont Avenue line in Baltimore.

Frederick (Md.) Railroad.—This company has practically completed its improvements at Frederick, which include between 7 and 8 miles of new track with terminal facilities. The entire system, including the Thurmont division, has been electrified. It is understood that the company will extend the line from Jefferson to Brunswick, a distance of about 7 miles, intersecting the main line of the Baltimore & Ohio Railroad. The extension of the Thurmont division to Emmitsburg and Gettysburg is also being considered.

Hagerstown & Clearspring Railway, Hagerstown, Md.—This company has awarded a contract to the Maryland Steel Company for 1200 tons of steel rails. The company has purchased a right-of-way along a portion of the Hagerstown-Cearfoss Turnpike. The new road will extend from Salem Avenue, Hagerstown, and run through Cearfoss and Greencastle to Mercersburg. The rights-of-way between Greencastle and Mercersburg have already been secured, it is announced, and $100,000 has been subscribed for the construction of the road. L. N. Downs, Hagerstown, president. [E. R. J., Sept. 16, '11.]

Boston & Worcester Street Railway, Boston, Mass.—This company has completed a double-track line at Framingham Center.

Berkshire Street Railway, Pittsfield, Mass.—This company placed in operation on Sept. 26 its extension between Canaan and Great Barrington.

Gogebic & Iron County Railway & Light Company, Marquette, Mich.—This company will begin work at once on an extension between Bessemer and Marquette.

Yazoo Valley Electric Railway, Light & Power Company, Yazoo City, Miss.—This company advises that it is as yet only in the preliminary stage. It proposes to build an electric railway between Yazoo City and Canton. H. Wise, Yazoo City, is interested. [E. R. J., Sept. 23, '11.]

North Missouri Central Railway, Mexico, Mo.—It is reported that this company has been reorganized and arrangements made whereby P. M. Johnson, St. Elmo, will build this line between Jefferson City and Columbia. This is part of a plan to build a 63-mile electric railway between Jefferson City and Mexico via Columbia, and a branch line from Columbia to Moberly, a distance of about 39 miles. [E. R. J., June 17, '11.]

Buffalo & Lake Erie Traction Company, Buffalo, N. Y.—Work will now proceed with double tracking the East Sixth Street branch east of Buffalo. Right-of-way has been secured.

Union Railway, New York City, N. Y.—The Public Service Commission has approved the terms of the franchise granted by the Board of Estimate recently to the Union Railway for an extension southerly on Broadway from 230th Street, crossing Spuyten Duyvil Creek, and down to 225th Street, just north of the ship canal.

Syracuse (N. Y.) Rapid Transit Railway.—Arrangements have been made by this company to begin work at once on the reconstruction of its tracks in North Salina Street, Syracuse, with new concrete foundations, new ties and rails. The company will make several other improvements of its lines in Syracuse.

Fargo & Moorehead Street Railway, Fargo, N. D.—It is reported that this line will be extended to Dilworth by the H. M. Byllesby Company.

Cadiz (Ohio) Traction Company.—The plans of the proposed electric line at Cadiz, it is said, are to begin with the section of road between Cadiz and Dennison and eventually build eastward to the Ohio River with Mingo Junction as the terminal, and westward via Coshocton to either Newark or Zanesville, for the purpose of connecting with the Indiana, Columbus & Eastern Traction Company, Cincinnati, whose present eastern terminal is Zanesville. At Mingo they can connect with the Steubenville lines through to both Pittsburgh and Wheeling. Robert P. Scott, Cadiz, is interested. [E. R. J., Sept. 9, '11.]

People's Electric Railway, Muskogee, Okla.—This company has placed in operation its interurban line between Muskogee and Fort Gibson. Edison storage battery cars are used.

Oregon Electric Railway, Portland, Ore.—Grading has been begun by this company on its extension between Salem and Albany.

West Penn Railways, Pittsburgh, Pa.—The grading of this company's extension from Vance's Mills to Phillips has been completed. In a few weeks the company plans to be operating to Phillips, which is 2 miles from Vance's Mill.

Sunbury & Selinsgrove Street Railway, Sunbury, Pa.—This company has awarded a contract to the Eyre-Shoemaker Company to construct its extension from Front Street, Sunbury, to a point above Packer's Island, where it will cross the river on a bridge to be built and enter Northumberland. Arrangements have been made and work will be begun at once at the Northumberland end of the line.

Columbia, S. C.—The Columbia Electric Street Railway, Light & Power Company has asked the City Council for a franchise to change and extend some of its tracks in Columbia.

Chattanooga Railway & Light Company, Chattanooga, Tenn.—A contract was awarded to the Noll Construction Company, Chattanooga, by this company for raising its tracks on Rossville Avenue and for the grading of Rossville Avenue between East End Avenue and the city limits of Chattanooga.

Ft. Worth (Tex.) Southern Traction Company.—This company has filed a deed of trust to the New England Trust Company covering the right-of-way from Ft. Worth to Cleburne. The mortgage was made to secure an issue of bonds to the amount of $1,000,000, the proceeds of which will be used to build an electric railway between Ft. Worth and Cleburne, via Everman, Burleston and Joshua. C. H. Clifford is interested. [E. R. J., Sept. 30, '11.]

Nooksack Valley Traction Company, Bellingham, Wash.—Work on the construction of this line will soon be begun. The first section to be built will be between Bellingham and Blaine. Bids have been asked for this work. In addition to this a contract has been entered into with the Northwest Canada Electric Company for a supply of power from the plant at Slave Lake. It is reported that the entire bond issue of this company has been disposed of by London capitalists. The line will connect Bellingham, Sumas, Ferndale, Lynden and Blaine. S. Alsop, Bellingham, is interested. [E. R. J., Aug. 12, '11.]

Seattle, Wash.—R. H. Thomson, city engineer, and A. L. Valantine, superintendent of Public Utilities, are reported to have been instructed by the Board of Public Works to prepare plans and specifications for all necessary roadway, overhead construction, rolling stock, equipment and apparatus for the construction of a municipal railway costing $800,000 and running between Seattle and Renton. Bids for the work are expected to be called for some time in October. [E. R. J., Sept. 23, '11.]

Fairmont & Clarksburg Traction Company, Fairmont, W. Va.—It is reported that this company has placed in operation its 7-mile extension to Mount Clare. This is part of the proposed 25-mile extension to Weston.

SHOPS AND BUILDINGS

Capital Traction Company, Washington, D. C.—Plans have been completed by this company to reconstruct its carhouse in Washington, D. C., at P and Water Streets. Southwest.

Philadelphia & Wilmington Traction Company, Wilmington, Del.—Plans are being prepared by this company for the construction of a club room for its employees at its offices in Chester. The addition will be 22 ft. x 30 ft.

Kentucky Traction & Terminal Company, Lexington, Ky.—This company has awarded a contract to Fred J. Rump, Versailles, for the construction of a new passenger station and freight house in Versailles, on Lexington Street, near Main Street. The structure will be of brick construction, and will include a substation.

Frederick (Md.) Railroad.—This company is building a new carhouse and passenger depot at Frederick.

Omaha & Council Bluffs Street Railway, Omaha, Neb.—This company will build an additional shop building at Twenty-sixth Street and Lake Street, in Omaha. The structure will be of brick construction, one story high, 24 ft. x 140 ft.

Piedmont Traction Company, Charlotte, N. C.—This company has awarded to Fred A. Jones, Charlotte, a contract for the construction of combination passenger and freight depots at Lowell and at Mount Holly and a freight depot in Charlotte, which will be a two-story building 240 ft. long, of white brick, with a tile roof. Plans are by Hook & Rogers, Charlotte.

Interurban Railway & Terminal Company, Cincinnati, Ohio.—This company's carhouse, located at California, Ohio, and sixteen cars were destroyed by fire on Sept. 23.

Seattle, Renton & Southern Railway, Seattle, Wash.—A new one-story substation will be built by this company on Rainier Avenue in Seattle.

POWER HOUSES AND SUBSTATIONS

Savannah (Ga.) Electric Company.—This company is increasing the capacity of its Indian Street power plant. Two 490-hp Sterling boilers, one 500-kw belt-driven generator, one 75-kw exciter and necessary switching and metering apparatus will be installed.

Chicago, Ottawa & Peoria Railway, La Salle, Ill.—This company will increase the capacity of its power plant and place a portable substation on the eastern division.

Kentucky Traction & Terminal Company, Lexington, Ky.—This company has awarded a contract to Fred J. Rump, Versailles, for the construction of a new substation in Versailles. [E. R. J., Sept. 16, '11.]

Gogebic & Iron County Railway & Light Company, Marquette, Mich.—This company will build a hydroelectric plant at Saxon, on the Montreal River, which will supply energy to its properties in Marquette and environs.

Northampton Traction Company, Easton, Pa.—This company has arranged to purchase its power of the Eastern Pennsylvania Power Company.

Manufactures & Supplies

ROLLING STOCK

Northampton (Mass.) Street Railway has ordered a snow plow from the Wason Manufacturing Company.

Union Railway, New York, N. Y., has ordered two long-cab snow sweepers from The J. G. Brill Company.

Union Electric Company, Dubuque, Ia., has ordered one McGuire-Cummings long-broom, steel-underframe snow sweeper.

Ottawa (Ont.) Electric Railway has ordered six Brill 27-FE-1 trucks from The J. G. Brill Company through the Ottawa Car Company.

Ft. Smith Light & Traction Company, Ft. Smith, Ark., has ordered seven Brill 21-E trucks without wheels from the American Car Company.

Dayton & Troy Electric Railway, Dayton, Ohio, has ordered two type HL control equipments from the Westinghouse Electric & Manufacturing Company.

Chicago (Ill.) City Railway has ordered three McGuire-Cummings single-truck, steel-underframe, long-broom snow sweepers from the McGuire-Cummings Manufacturing Company.

Bluestone Traction Company, Bluefield, W. Va., has ordered one double equipment of No. 101-B-2 motors and type K-10-A control from the Westinghouse Electric & Manufacturing Company.

Raymond & South Bend Railway, Raymond, Wash., has ordered three 20-ft. closed motor-car bodies mounted on Brill 21-E trucks from the G. C. Kuhlman Car Company, through Sanderson & Porter, New York.

Oakland & Antioch Railway, San Francisco, Cal., has ordered four quadruple equipments of No. 321 motors and control, one quadruple equipment of No. 332-E motors and control, and one locomotive equipped with four No. 308-B-6 motors and control from the Westinghouse Electric & Manufacturing Company.

TRADE NOTES

Wagner Electric Manufacturing Company, St. Louis, Mo., has filed a certificate of an increase in its capital stock from $1,200,000 to $1,500,000.

C. A. Wood Preserver Company, St. Louis, Mo., has received orders within the last ten day for over 1000 barrels of its wood-preserving compound.

Pay-as-You-Enter Car Corporation, New York, N. Y., has declared the regular quarterly dividend of 1¾ per cent, payable to stockholders of record Oct. 15 through the Standard Trust Company of New York.

American Bureau of Inspection and Tests, Chicago, Ill., has appointed E. C. McMillan manager of the company, with office at Pittsburgh, Pa., to succeed George W. Greene, resigned. Mr. McMillan was formerly mechanical engineer of the company.

T. H. Symington Company, Baltimore, Md., announces the resignation of W. A. Garrett, vice-president, who is to re-enter railroad service. Mr. Garrett was formerly chief executive officer of the Seaboard Air Line. The company has appointed J. A. Sauer manager of its New York office to succeed C. S. Arthur, who has resigned to become connected with the Wales Adding Machine Company, Atlanta, Ga. Mr. Sauer was formerly secretary to the vice-president of the company.

C. J. Nash, who has been with the Westinghouse Air Brake Company, Pittsburgh, Pa., as special representative in the draft-gear department for the past year, has resigned to engage in the railway supply business, where he will make a specialty of draft-gear attachments. Mr. Nash was mechanical engineer for the Pullman Company, Chicago, in charge of the contract car construction and the estimating department, for sixteen years. In 1905 he was superintendent of the wood-car department and in charge of the steel passenger-car department of the Standard Steel Car Company, Pittsburgh, Pa. He was then appointed chief mechanical engineer of the W. H. Miner Company, Chicago, which position he held until he went with the Westinghouse Air Brake Company.

Knox, Heskett & Company, Chicago, Ill., is the new name of the Knox Engineering Company, Chicago, Ill. The stockholders of the Knox Engineering Company at a meeting held Oct. 5 authorized the name of the company to be changed and the capital stock increased to $100,000. R. M. Heskett has held the position of vice-president since the organization of the Knox Engineering Company in 1902. Mr. Heskett is a graduate of the Armour Institute of Technology, and previous to his connection with the Knox Engineering Company has had a general experience in the operating and construction field. As vice-president of the Knox Engineering Company he has been prominently identified with the operations which this company has carried on during the last ten years. The increase in capital stock is demanded by the growing scope of the firm's business.

ADVERTISING LITERATURE

W. N. Matthews & Brother, St. Louis, Mo., have issued an illustrated advertising post card, describing and giving prices of sleet cutters.

Warren Webster & Company, Camden, N. J., have issued an illustrated folder describing typical installations of heating and air-purifying systems.

A. D. Joslin Manufacturing Company, Chicago, Ill., has issued Catalog No. 1, which describes and illustrates the various models of the Cosmo dating stamp manufactured by the company.

Railway Roller Bearing Company, Syracuse, N. Y., has published a 34-page catalog in which are described and illustrated Rollway journal boxes, car wheels, center plates, motor frame heads and motor bearings for railway purposes which the company manufactures.

Bayonet Trolley Harp Company, Springfield, Ohio, has issued a fifty-four-page catalog which describes and illustrates the various types of trolley bases, harps, wheels and sheet cutters which the company manufactures. For the convenience of the buyer the different parts of the devices

Wheeler Condenser & Engineering Company, New York, N. Y., has issued Bulletin No. 103, which is a new illustrated edition of its bulletin on the Wheeler-Edwards air pump for operation in connection with surface condensers handling both air and condensed steam.

Crocker-Wheeler Company, Ampere, N. J., has published a booklet describing its new design of indication motors. These motors have magnetic bridges and the booklet shows how these bridges and other features add to the operating characteristics and mechanical durability of the motors.

Under-Feed Stoker Company of America, Chicago, Ill., has issued the September number of *Publicity Magazine*, which describes typical installations of Jones under-feed stokers and their operation. It also contains a map of the world, showing places where Jones stokers are in use.

McGraw-Hill Book Company, New York, N. Y., has issued its first complete catalog of engineering books. Nearly 400 books on all branches of engineering are listed, including twenty-six books on electric railway subjects. Among the new books on electric railways are "Electric Railway Engineering," by C. F. Harding, and "Electric Traction for Trains," by E. P. Burch.

Titanium Alloy Manufacturing Company, Pittsburgh, Pa., has issued a booklet containing two sets of tables and rail profiles relating to the second series of tests by the Baltimore & Ohio Railroad on titanium Bessemer rails and plain open-hearth rails covering 338 days' service in 1910 and 1911. Although containing 36 per cent less carbon, the titanium rails showed 56 per cent greater durability than open-hearth rails. The following is a summary of the tests: Percentage of wear from plain open-hearth rails, average, 0.277; percentage of wear from titanium Bessemer rails treated with 0.15 per cent metallic titanium, average, 0.177; carbon content in plain open-hearth rails, average, 0.47; difference in carbon content in favor of the open-hearth steel, 0.17, or 36 per cent; difference in wear in favor of titanium steel, 56 per cent. In the previous trial on this curve, plain Bessemer rails showed 294 per cent more wear than titanium Bessemer rails.