33

2

61337

THE

Street Railway

Journal.

INDEX TO VOLUME XXVII.

January to June, 1906.

McGraw Publishing Co.,
114 Liberty Street,
New York.

INDEX TO VOLUME XXVII.

(Abbreviations: * Illustrated. c Correspondence.)

D

E

F

G

H

I

O

P

Q

R

S

T

AUTHORS' INDEX

Street Railway Journal

Vol. XXVII. NEW YORK, SATURDAY, JANUARY 6, 1906. No. 1.

Published Every Saturday by the

McGraw Publishing Company

Main Office:
NEW YORK, Engineering Building, 114 Liberty Street.
Branch Offices:
Chicago: Monadnock Block.
Philadelphia: Real Estate Trust Building.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York"; "Stryjourn, London"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada, Mexico and the Canal Zone.

Street Railway Journal (52 issues)....$3.00 per annum
Single copies....10 cents
Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August and November) $4.00 per annum
Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy)....$6.50 per annum

To All Countries Other Than Those Mentioned Above:
Street Railway Journal (52 issues), postage prepaid.... $6.00
25 shillings. 25 marks. 31 francs.
Single copies....20 cents
Remittances for foreign subscriptions may be made through our European office.

NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the Street Railway Journal.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires.

Of this issue of the Street Railway Journal 8500 copies are printed. The total circulation for the year 1905 was 424,350 copies, an average of 8160 copies per week.

The Prospects for 1906

At no period in the history of electric railroading has the future for a coming twelve months seemed so fraught with important developments as at the beginning of the present year. The industry, which was not even in existence twenty years ago, and ten years later had not emerged from the limitations which the use of direct-current systems of distribution entailed, now promises to gather a large number of the trunk lines of the country in its folds. This application of electric power to trunk line service, which has ever been one of the favorite ideals of the electrical inventor, now seems measurably within accomplishment. Certainly at no previous period has there been not only so much interest but so much actual work under way. The New York Central and Pennsylvania terminals in New York City were under contract a year ago, and were in a sense obligatory, as local conditions would not permit the use of steam power. This remark, however, does not apply to the plans of the Pennsylvania Railroad for its Atlantic City line, those of the Erie in Central New York, the electrification of sections of the West Shore Railroad by the New York Central, the Long Island Railroad work, or entirely to the plans of the New York, New Haven & Hartford Railroad, whatever they may actually be.

Turning now to interurban and city electric railway work, we find on existing roads rapidly increasing gross earnings as compared with last year, although expenses of labor and material are high—higher in fact than for many years past. Upon this fact certain managers have been disposed to take a somewhat gloomy view of the outlook. It may be that everything which goes into electric railway operation costs more than it did last year, while fares are no higher. We will admit as equally true that some lines have been built upon a mere speculative chance of traffic in regions where the population served would not justify the expense. That such roads have failed should occasion no surprise, but that the ordinary road, built at the present time with any regard to reasonable capitalization and traffic return, is likely to prove a bad investment, we are by no means ready to admit. In a term of years costs even themselves up, and if copper is 20 cents to-day it may be 12 in a few months. From a rational standpoint, a property which returns a good rate of interest on the money actually invested is financially sound. The country is growing more populous and richer every day, there is growing necessity for quick transportation, and people have the money to pay for it. Success means getting next to the people, and at the beginning of the new year, when the outcome during the next twelve months is foremost in the minds of all, it ought not to be out of place to refer to the keynote of success in management.

There is no other important business in which the receipts are in so small units derived from so many individuals. The one point in which consolidated systems are sometimes weak is in keeping the local situations in touch. The prosperity of a road depends absolutely upon keeping on friendly terms with the man with the nickel. The chap with the check book may get around to stockholders' meetings and kick, but he does not contribute much toward the dividends. It does no good to explain to the locally enraged that the management would be pleased to give better service if it could do so and still declare its dividend. Until the service is forthcoming the man with the nickel holds back unless spurred by necessity, and no amount of argument or advertising does any good. In spite of high expenses the road that stands closest to the popular interests will in the long run win prosperity in good times and in bad.

In this discussion of street railway conditions at the beginning of 1906, we might add a few words in regard to this paper itself. As in the past the Street Railway Journal will endeavor to give to all of its readers the most accurate, prompt and best all around service possible. It will discuss all of the subjects—technical, financial, operating and commercial—

which affect the electric railway field, whether relating to city, interurban or heavy electric railroading. It will give equal attention to any possible substitutes for electricity, such as gasoline motor cars, which may prove efficacious for solving the problem of light interurban traffic. It will maintain its practice of treating the most important of these topics editorially, especially those which affect the operating force, and hopes to warrant the continuation of the favor which its readers have always accorded it in the past.

Annual Passes

Just at present a wave is sweeping over the railways of the country in favor of the abolition, or at least the restriction, of passes of all kinds. Both steam and street railway companies have definitely announced their intention of adopting this plan with the beginning of the new year. Among the former are the Pennsylvania, New York Central, Reading, Erie, Lackawanna and Lehigh Valley. Among the street railway companies which will enforce a similar policy is the Philadelphia Rapid Transit Company, which has discontinued all passes, except for officers and employees of the company, policemen and firemen in uniform and officials of connecting lines. In fact, in practically all cities where free transportation has previously been permitted in certain cases, a much stricter drawing of the lines will be enforced.

There is no doubt that there has been a serious abuse of the pass privilege in the past, and we heartily endorse any steps which may be taken to reduce or abolish it. The grant of a pass may often seem the easiest way to gain a man's friendship, because nothing delights the average American so much as the thought of getting something for nothing, and when the gift takes the form of a free use of a public service, it appears of much greater value than would its equivalent in money. The practice of companies in granting free transportation has differed radically in the past, from the plan under which no passes are given even to officials and employees, as on the Boston Elevated, to that which the road is mulcted to the extent of free rides by any politician who can make a successful strike on the officers. We believe that the system has been greatly abused in this country, and that the present is an excellent time to reduce it. If a railway company is strong enough to take an advanced position in the matter it is desirable to do so. If it should not seem best to cut off all passes, at least a step can be made in that direction.

The A. C. Railway Situation

In another column we are glad to be able to present a very thorough and careful review of the a. c.-d. c. railway controversy by Mr. Lamme, who certainly is able to speak from first-hand knowledge of the case, being no stranger to the various peculiarities of either type. In particular, he takes up the question of direct-current motors at high voltage which has been recently raised, and looking at the matter from a purely practical standpoint, calls attention to the fact that in spite of the great desirability of higher voltage for the sake of economical distribution, the actual working pressure has not been raised more than 100 to 150 volts in fifteen years of active railway development. Of course, a natural conservatism and the desire to use thoroughly standard apparatus is not without its bearing on this situation, but Mr. Lamme adds a plain statement of the somewhat serious difficulties involved in the design and use of d. c. apparatus for high voltage. He might well have added, that in spite of the voltage attained in some of M. Thury's constant-current machines their current capacity still remains very moderate. He also discusses, from the standpoint of a builder, the design of a satisfactory 1500-volt rotary converter, and points out very serious difficulties. The commutator problem in these machines is quite bad enough, even at the present moderate voltage. In addition, controlling apparatus for high voltage is rather serious business when large currents are to be controlled. Add to this the fact that even a 1500-volt distribution is only a palliative measure in long-distance working, and the difficulties of the situation are obvious.

One interesting feature pointed out by Mr. Lamme is that the measures required in designing a large a. c. motor for traction are of the very same kind demanded for successful d. c. working at high voltage. His article indicates, therefore, that so far as motors are concerned, the two propositions would be nearly at a stand-off, with the a. c. motors losing somewhat in weight efficiency and hysteresis, and gaining considerably in the simplicity of the control. As regards the general scheme of distribution, he declares there is no comparison, and once the transformer is located on the car, the voltage on the working conductors can be almost anything one pleases, even up to 15,000 or 20,000 volts. This is the commanding feature of a. c. traction, that the voltage on the trolley line is independent of the limitations imposed by the motor. One may, in fact, abolish the feeding system and connect the trolley wires directly to the high-voltage generators or the raising transformers. From an operative standpoint, the a. c. apparatus has the great advantage of having substantially no really inefficient speeds, such as affect d. c. apparatus in the passage from series to multiple connections. In the kind of electric railway work now most acutely needing attention, this gain does not rise to immediate value, but in the large field of railroad working its importance would be felt.

So far as efficiency and cost of equipment is concerned, Mr. Lamme takes a conservative position. One point to which he calls attention is the somewhat increased cost of single-phase generators over polyphase generators of the same output and characteristics, and the need of close regulation of the generators in case of a. c. operation. In the single-phase roads now installed the generator is generally a polyphase machine with all the phases in use on the various sections of the line; but how easily this arrangement could be used in the more general scheme remains to be seen. A pure single-phase generator costs something like 20 per cent more than a similar polyphase generator, so that the adaptation would be worth making.

So far as the general situation is concerned, our position has been many times stated. We have preached high voltage on the working conductors in season and out, until we began to think of ourselves as a voice crying in the wilderness. But the world does move, and improvements are coming rapidly. We hold no brief for the single-phase series motor—what happens to the energy after it reaches the car is from the wider view a minor consideration. If the series motor can best do the work, well and good; if it cannot, the polyphase motor is not dead yet, and the Leonard plan is by no means to be despised. But a voltage that will enable 500 or 1000 kw to be delivered from overhead-working conductors at long distances is imperative, if electric traction is to take the place which its friends hope for it. A thoroughly operative 1500-volt d. c. system is undoubtedly a step in the right direction, but after all a very short one compared to 15,000 volts, and with the collection difficulty still to be dealt with. We do not, also, believe that the "third-rail system" is a finality in heavy railway work. It has been immensely useful in certain cases, and will continue to be so, but it is inferior to the trolley, and has been used only because it was necessary, on account of the very heavy currents demanded at our "standard" level of railway voltages. The vital question at this particular moment is whether the single-phase series motor can make good its claims in working on a large scale. Mr. Lamme's comparison of it with the high-voltage d. c. motor points out the nature of the difficulties that must be met. They are by no means trivial, either in theory or in practice. The next few months should throw considerable light on the situation. Only actual work on a considerable scale can be relied upon to settle the practical aspects of the matter. The main issue, that of high voltage, does not stand or fall by the success or failure of any particular type of motor.

San Francisco's Street Traffic Problem

Some time ago the Merchants' Association, of San Francisco, undertook to make an investigation of the transportation and street traffic conditions in that city and with laudable enterprise engaged William Barclay Parsons to go over the situation and recommend a general plan for the improvement and development of the city's street and transportation arrangements. Mr. Parsons made an exhaustive study of the problem and has presented his report, to which we devote considerable space in this week's issue. Topographically the conditions existing to-day in San Francisco are abnormal to those of any other city of the same size and importance in the world. The surface of the peninsula upon which the city lies is much broken by ridges and peaks, some of which rise to an altitude of 800 ft., and the commercial and residence sections have spread up and over these ridges and hills seemingly in direct defiance of grades and topographical obstacles. There are many rows of houses in the best sections of the city located on streets with grades in excess of 22 per cent and before whose doors there has never been a wagon. On these streets the delivery of everyday supplies and household requisites are made from the nearest cross streets above or below.

The persistency with which the residential sections have gradually crept up the slopes of apparently inaccessible hills has naturally created an enormous demand for transportation facilities whereby the hill residents can reach the business and commercial districts at the foot of the hills, but it has concurrently increased enormously the mechanical difficulties in the way of supplying this demand. Because of these grades San Francisco was one of the first cities to turn to cable traction as a solution for her transportation dilemma, and it has to-day a greater mileage of cable roads than any other city in the world. However, in comparison with the city's development, the limits and shortcomings of the cable have made themselves painfully evident, and all of the new lines that have been built within recent years, at least in the suburbs and in the less hilly sections, have been equipped for electric traction.

During the past five years the city has grown enormously in population and in business and commercial activity and it now faces the very serious problem of remodeling not only its transportation arrangements, but its general street conditions as well, or else the city stands in danger of seeing a considerable portion of its wealth and business interests pass to less important suburbs across the bay. These are the conditions that Mr. Parsons was called upon to investigate, and for which he was asked to recommend a feasible solution.

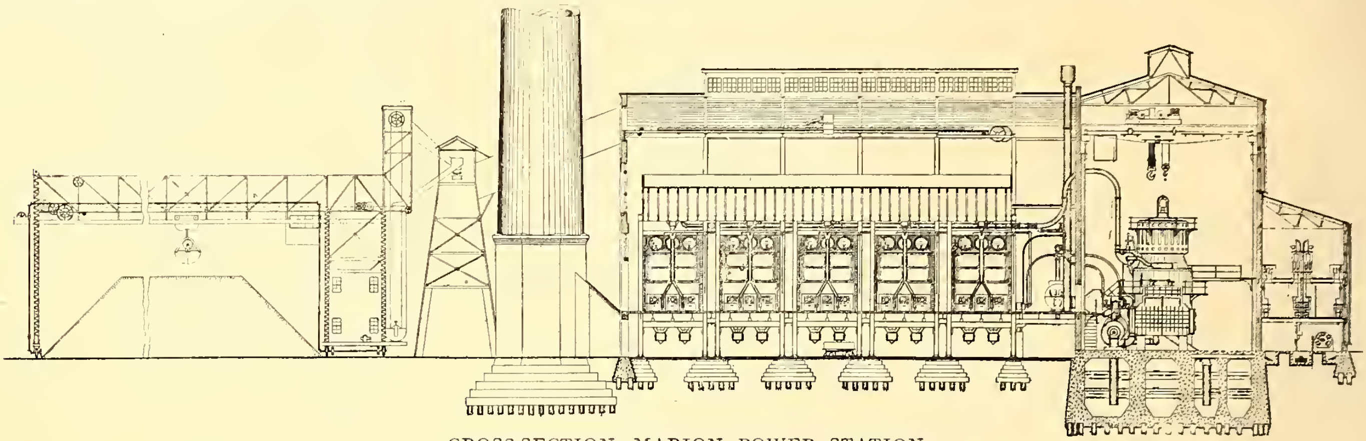
In a nutshell, the report aims to show that the cables are not as necessary to San Francisco as they have appeared to be. It unqualifiedly recommends that all present forms of motive power, including steam, horse and cable, be abolished, and that one system of electrical operation be adopted and made uniform throughout the city. Mr. Parsons further recommends that this system be the overhead-trolley. Because the Merchants' Association has heretofore stood firmly opposed to overhead trolley wires in business districts, Mr. Parsons takes pains to review at considerable length the history of the more important systems of electric traction, and particularly the development of the conduit system in New York and Washington. In urging against the adoption of the conduit he gives two most excellent reasons for his opinion; namely, that its introduction as a part of a growing system of railroads means the entrance of a new factor in operation and the destroying of uniformity, and second, the operation of the conduit is known to be both expensive and to involve the possibility of troubles and delays not present with the overhead trolley. He makes the statement that one-third of the delays on the conduit system in New York are due to accidents to the conduits. As an expert, thoroughly familiar with transportation development in this country and abroad, he was forced to conclude that the overhead trolley presents the only feasible substitute for cable traction on the street railways of San Francisco. Coupled with this recommendation, however, he advises the burying of all feed and transmission wires and the adoption of poles designed according to the highest artistic standards with arrangements to combine arc lighting with the overhead suspension of the trolley, so that one pole will serve for both purposes. In narrow streets where center poles are not possible he recommends attaching the wires to buildings by special ornamental rosettes. This is good advice and entirely in accord with modern experience that the presence of the overhead trolley in city streets should not and need not mean the disfigurement of the streets.

The report recommends substituting the trolley for the cable on all lines where the gradients are not in excess of 14 per cent, as this is taken as a safe limit for operation by electric traction. For the few lines that cannot be reduced to negotiable gradients the report suggests special solutions, which involve in one or two cases a change of the routes to adjacent streets, and in other cases tunneling under the peaks of the hills and carrying the overhead trolley through these tunnels. The tunnels would be reached from the surface by elevators and staircases. With the recommendations concerning the changes in transportation facilities an ingenious scheme is proposed for rendering the streets in the hill districts accessible to vehicle traffic. This includes the plan of terracing the streets so that the roadways will climb the hills by a series of winding inclines with easy gradients.

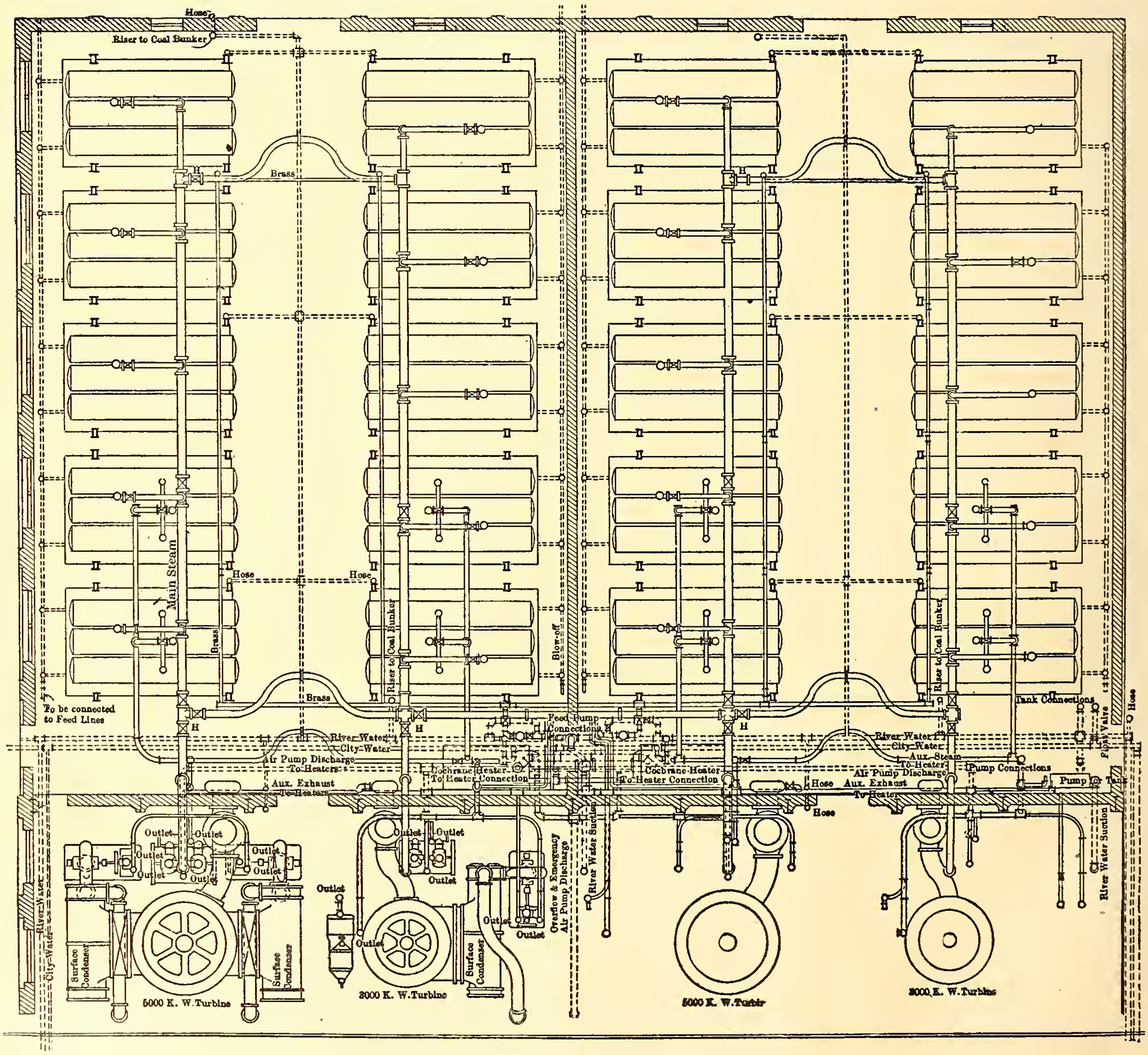
Because the Merchants' Association had set its heart on having the conduit system adopted in San Francisco and wanted Mr. Parsons to concur in this opinion, we regret to note from the newspaper reports that some of the gentlemen instrumental in securing his services are inclined to hold that they have been "gold bricked." It would appear that the only way in which to avoid the troubles such as Mayor Dunne and the gentlemen of San Francisco have brought upon themselves, would be, when public-spirited officials want information about transportation matters, they had better apply to experts who do know much about the subject.

POWER GENERATION AND DISTRIBUTION ON THE SYSTEM OF THE PUBLIC SERVICE CORPORATION OF NEW JERSEY—I

The Public Service Corporation of New Jersey, whose head offices are in Newark, presents a striking example of the tendency to merge public utility enterprises for the purpose of securing the benefits of single management and what might be termed single engineering. The Public Service Corporation now controls, through a long series of purchases and mergers, practically all of the electric lighting, power, gas and street railway utilities of the larger portion of the State of New Jersey. The benefits to the public in this instance have been many, resulting in lower rates for light and power, better street railway facilities and longer rides, and a far more reliable and dependable service in the supplying of electric light, power, gas and electric railway transportation.



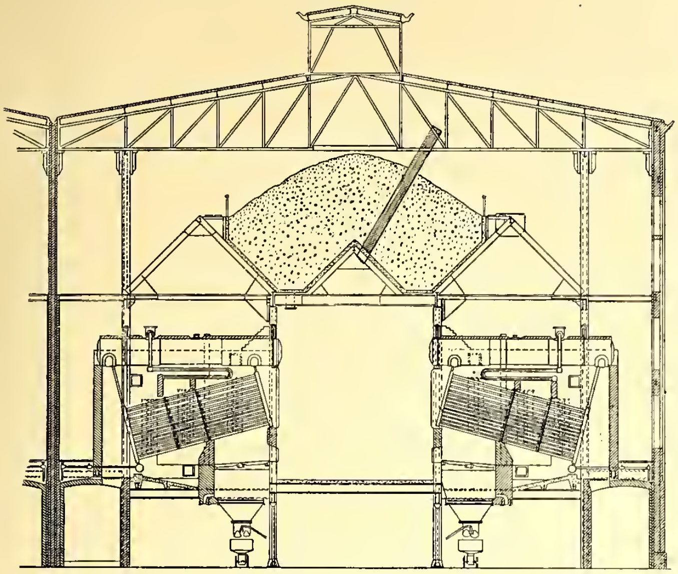
CROSS-SECTION, MARION POWER STATION



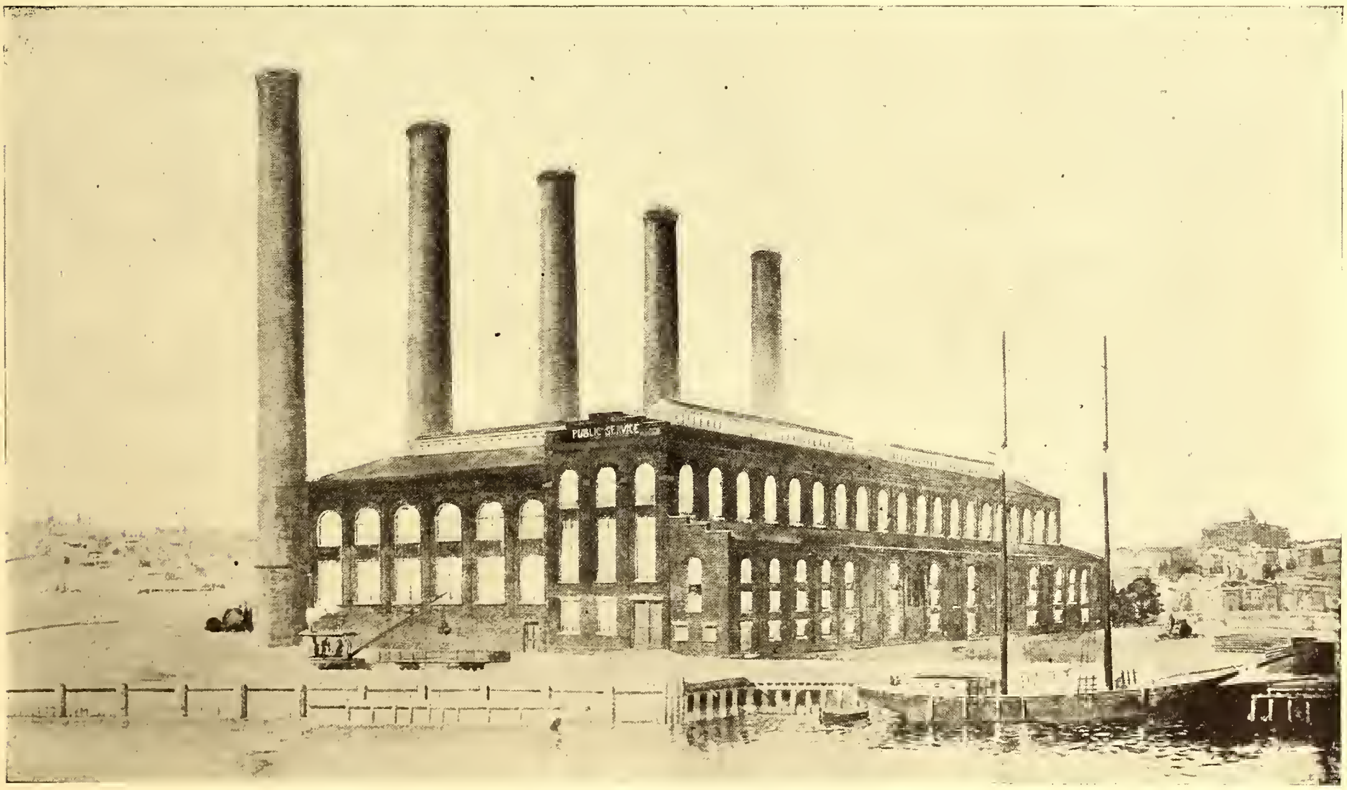
PLAN OF MARION POWER STATION

THE MARION (HACKENSACK RIVER) STATION

During 1903, in order to obtain increased power-generating capacity and also to secure a better arrangement of the then existing generating and distributing centers, the engineers of the company undertook the task of practically remodeling the entire power scheme, including the rearranging and discarding in part of some of the older stations that had been inherited by the parent company through the merging of the underlying properties; the establishing of new and more advantageous distributing centers; and the building of a new 13,000-kw power plant in the North Jersey section to care for the rapidly increasing business in this territory. This station is located at Marion, N. J., on the Hackensack River, where the corporation owns a tract of about 14 acres on the Hackensack Meadows between the river and a branch of the Pennsylvania Railroad. The Hackensack River gives excellent tide-water facilities for coal delivery in addition to direct connection with two steam roads.



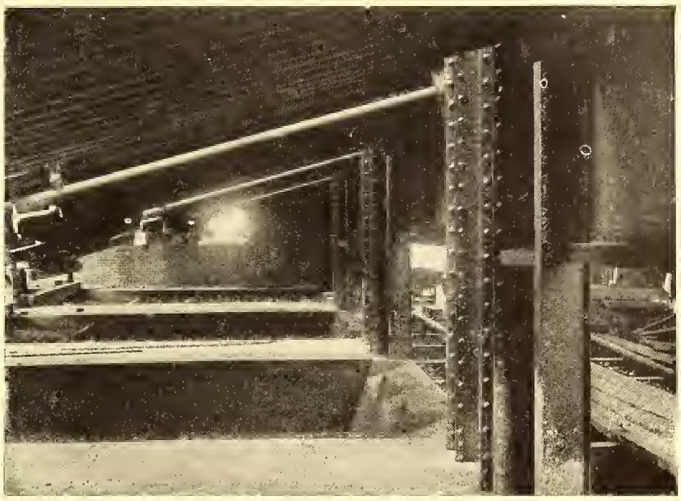
SECTION OF BOILER ROOM, MARION STATION



EXTERIOR MARION STATION

The station is well located with respect to the present central station and sub-stations and the districts to be supplied.

The building is substantial, though severely plain, no attempt having been made to gain architectural beauty. The walls are of red brick, except at the east end of the engine and switchboard building, where the wall is temporary and consists of corrugated iron laid on a light framework of steel. The engine room walls are lined to a height of about 20 ft. with white enamel brick, and for the rest of the height with a light buff brick.



FLAME PLATE AND ASH-PIT BELOW BOILERS

The boggy nature of the soil required care in the construction of foundations, which were built on reinforced concrete caps laid upon 3-ft. piling.

The engine room is 43 ft. x 150 ft. The boiler house is in two complete sections with a brick wall partition, and the two rooms together are 150 ft. x 115 ft. The switch and cable building is in reality a lean-to against the engine room wall and contains also the engineer's office. This addition is 21 ft. x 150 ft.

The generating equipment comprises two 5000-kw, 13,200-

volt, 25-cycle, three-phase, and one 3000-kw, 13-200-volt, 60-cycle, three-phase, General Electric Curtis turbo-generators. Provision for an additional 3000-kw unit is made in the present

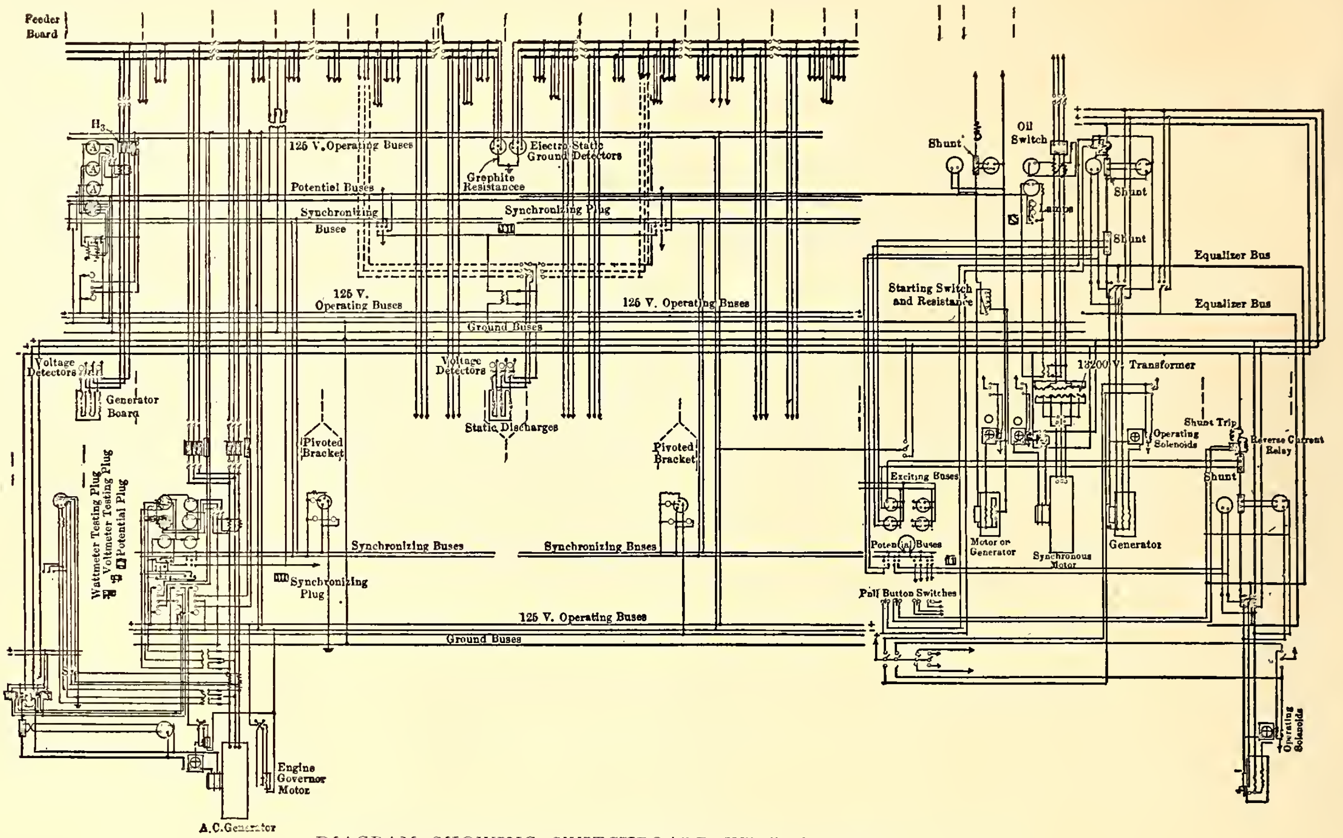
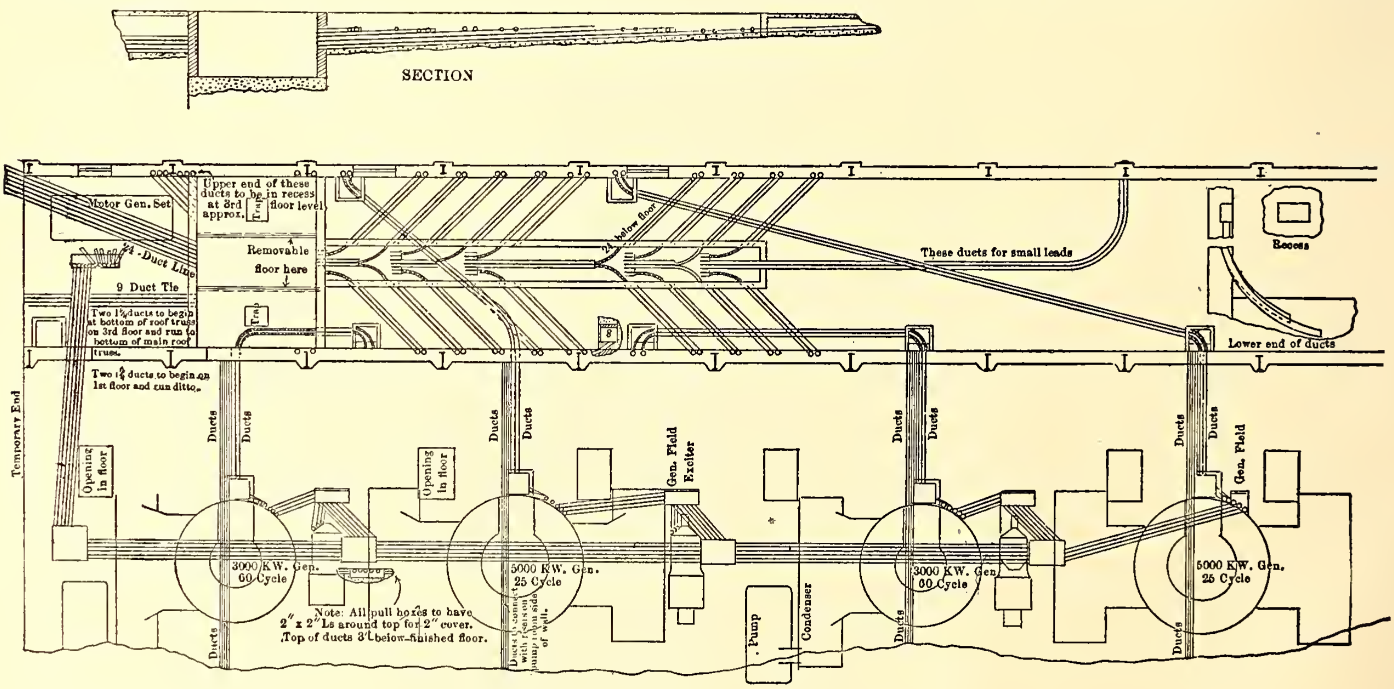


DIAGRAM SHOWING SWITCHBOARD WIRING, MARION STATION

engine room. At the bottom of the vertical turbine shafts there are bearings adjustable in a vertical direction, and the thrust of the revolving shaft is taken by a film of water constantly supplied by a pump at a pressure of about 800 lbs.



FLOOR AND WALL DUCTS, MARION STATION

The foundations of the turbo-generators are worth special mention. They consist of a system of reinforced concrete arches permitting a free flow of the river immediately below the turbines, there being a series of 36-in. clay pipes connecting with the river. These pipes turn downward at the edge of a dock at the river front, and are hung in position by cross beams before the space beneath the dock is filled in. The mouth of these 36-in. inlets are 13 feet below low tide, affording an ample supply of water for condenser purposes. Provision has been made at this time for the supply of inlets for the ultimate capacity of the plant to 64,000 kw.

The condenser outflow is led at an angle and away from the intakes into the river, below grade, by a 12-ft. x 12-ft. raceway, which has sides of sheet piling, bottom of concrete and is planked over on top.

A unique feature of the station is the double condenser built by the Wheeler Condenser & Engineering Company for the 5000-kw turbines. Each condenser has 10,000 sq. ft. of surface, or 20,000 sq. ft. to each 5000-kw unit. The top row of tubes in each condenser is used as a closed feed-water heater, the water flowing thence to the open Cochrane heaters, of which there are two of 6000-hp each. The 3000-kw turbine condenser has 12,000 sq. ft. of surface. Each turbo-unit has a duplex Edwards direct-driven suction valveless air pump, supplied by the Wheeler Company. This pump is 12 ins. x 30 ins. x 14 ins., and is used as the condenser and air pump.

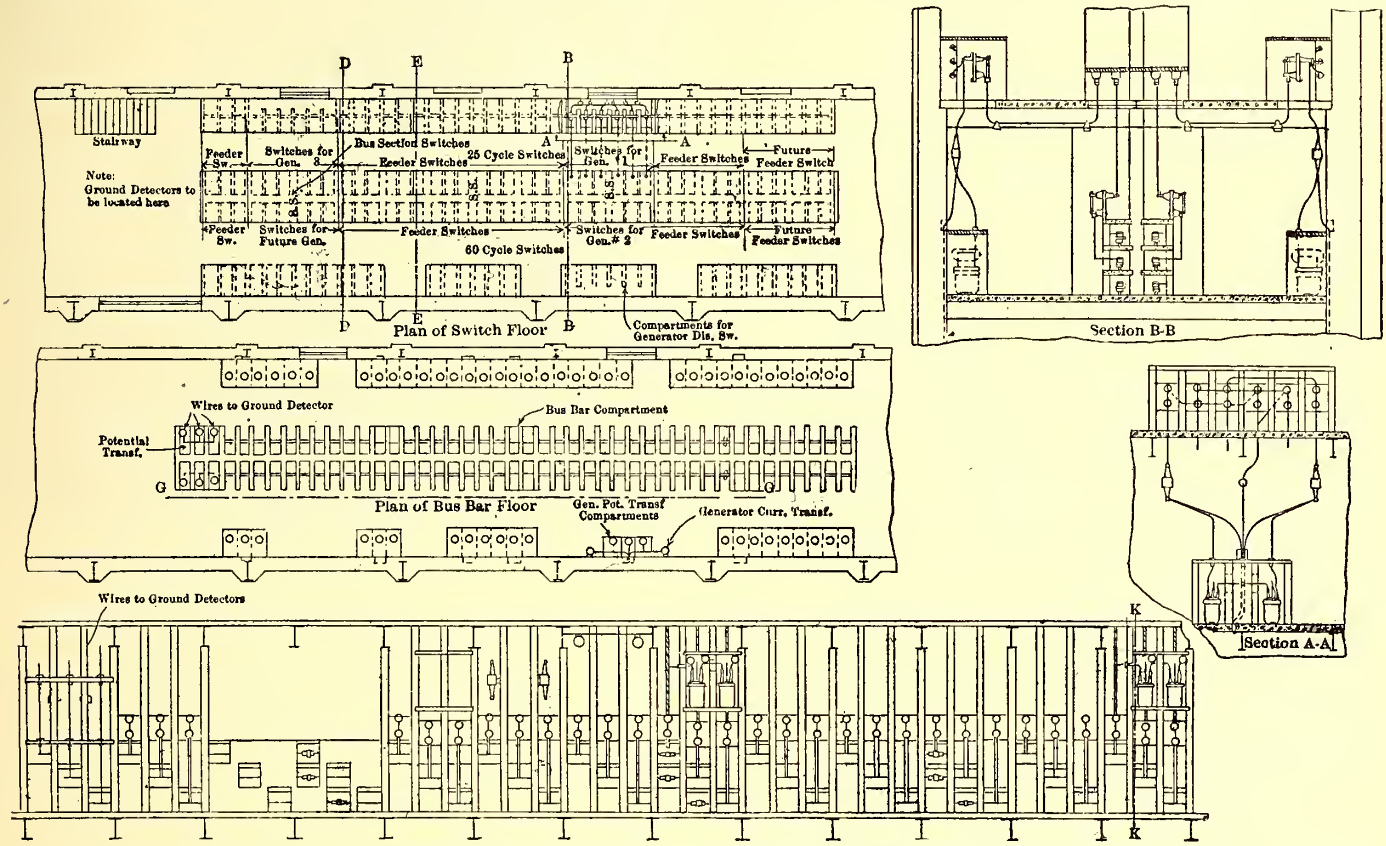
There are two 125-volt exciters, each of 75 kw., direct connected to small horizontal Curtis steam turbines. One of these generators is sufficient for the entire present equipment. These turbines are non-condensing and exhaust into the open heaters.

The exhaust from all the steam auxiliaries goes into a main leading into the open heaters, and by means of a divided box in this main between the two heaters, the inlet to each heater can be proportioned as desired.

A leader is taken from between the stages of the large turbines at about atmospheric pressure and run direct to the open heaters. This is to raise the temperature of the feed water up to 210 or 212 degs.

There are three vertical Warren boiler-feed pumps, each 14 ins. x 11 ins. x 12 ins. stroke, running 50 to 100 strokes per minute, capable of delivering 980 gals. per minute. Each has an 8-in suction and 7-in. discharge. The auxiliaries in this station are all steam driven and run non-condensing, utilizing the exhaust from them to the fullest extent for heating the feed water. The amount of such exhaust steam, however, in the turbine plant is not sufficient to raise the temperature more than 50 or 60 degs., so provision was made to bring this temperature up as stated.

In addition to the advantage of feeding hot water to the boilers at a constant temperature, there is considerable economy secured by this use of steam after it has done work from boiler pressure to atmospheric pressure in the turbine. Both the sensible heat and all of the latent heat is utilized in the heater while the only further work steam could do when used expansively in the turbine, is that due to difference of temperature from atmosphere to 28 ins. of vacuum. The amount of steam used for this purpose from the turbines will depend, of course, upon the proportions of station lead to steam obtained from the auxiliaries, this being controlled by a hand valve with a back-pressure valve in the line.



ARRANGEMENT OF SWITCHING APPARATUS, MARION STATION

The system of feed-water supply consists of the following parts: The Edwards air pump receives the water of condensation from the condenser and returns it to the open heater, which acts as a hot-well. The heaters are of sufficient capacity to store a 10-minutes' supply to the boilers. In the run between the air pump and the heater is a primary heater in the top rows of tubes of the surface condenser.

The water is forced through these condenser tubes, and by virtue of their contact with steam upon its return to the condenser, the water is heated to the full temperature of the vacuum; it is then led to the open heaters. The complete circuit of the system in feed water is from the boilers to the turbines as steam, from the turbines to the condenser, condenser to pump, pump through primary heater, primary heater to open heater, open heater to feed pump, and feed pump to boilers. The entrained air escapes from the discharge of the Edwards air pump through a 12-in. riser carried above the water line. Feed water is supplied from either the city mains or from spring water on the property.

There are fifteen Babcock & Wilcox 600-hp boilers, five boilers being in a half section supplying the smaller stack, and ten boilers in a section for the larger stack. Except the outer or half-section row, the boilers are back to back, the flues being of brick and below the boilers, sealed with cement. The flue dampers are iron plates swung on a vertical axis, and are at an angle when closed. McClave grates are used. There are no mechanical stokers, but provision has been made so that if desired they can be installed later.

Below each boiler is a flame plate, consisting of a slab of 6-in. reinforced concrete supported on each end on iron girders.

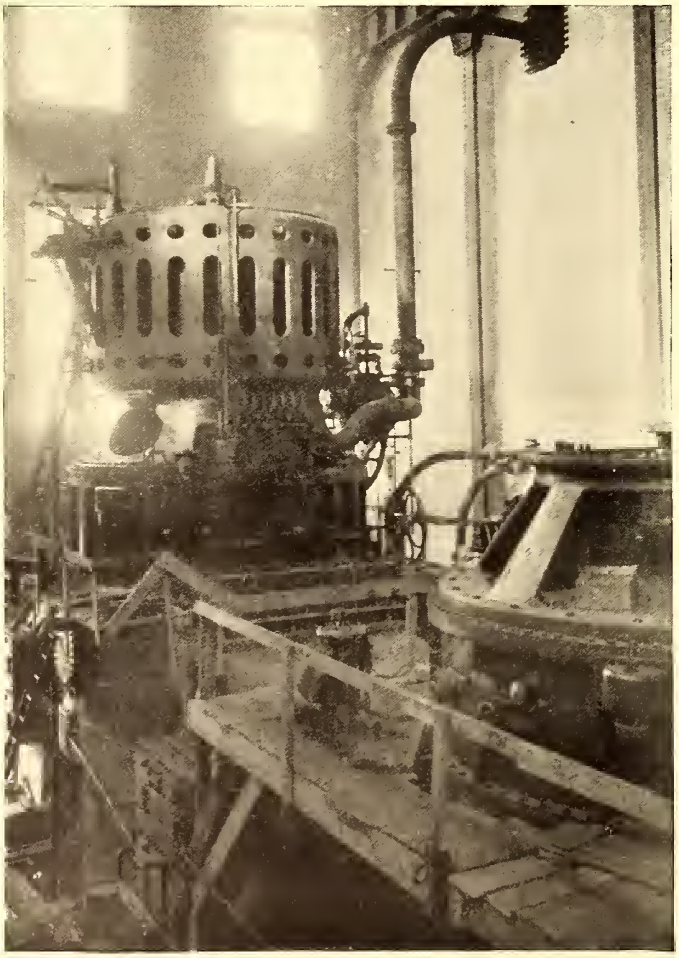
The steam piping is all overhead and is suspended from the structural steel framework, permitting free movement of expansion. So-called Van Stone joints, supplied by H. W. Kellogg, with vulcabeston gaskets are on all the 6-in. auxiliary mains and the 10-in. line steam feeder lines. All runs are curved to guard against straining joints. Chapman valves are on all steam connections except valves below 4 ins., where Hancock globe valves are used. The blow-offs are connected to the feed-water lines as an emergency source of feed-water supply to the boilers. The pipe covering on the superheated lines is 3 ins. thick, of 85 per cent magnesia, laid on in 1½-in. thicknesses, plastered with a ¼-in. layer of asbestos compound and then covered with 8-oz. duck sewed on. The other steam piping is sectional covering. The relief valves on the 5000-kw exhaust is a 36-in., and on the 3000-kw turbine a 30-in. Blake valve.

The coal is handled by electrically-operated machinery from the supply pile to the storage pockets over the boiler floor space, and is then let down on the floor by local coal chutes controlled by the fireman. The ashes drop from the grates into steel hoppers lined with concrete to conduct the ashes to chutes, the openings of which are controlled at will. Ash cars on standard-gage tracks receive the ashes direct from the chutes and convey them away from the plant.

WIRING

The cables from the generator to the generator busses, the exciter wiring and the general current controlling wiring and apparatus is shown in the accompanying illustrations.

The three conductor cables from the generators are all lead in ducts imbedded in the station floor to the basement of the switch building, thence exposed along the wall to the respective sectional bus. The system of busses of flat copper bars are separated one from the other by brick chambers. From the busses leads are taken to the respective circuit-breaking oil-pot switches, the triple circuit-making and breaking copper rods being mechanically operated and electrically controlled from the operating board.



TWO TURBO UNITS IN COURSE OF ERECTION, MARION STATION

The instrument panels and operating bench are placed at one end of the present top floor of the switchboard building and on a level with the gallery, which is on one side and end of the engine room and interconnects the turbines. The operator can overlook the generators and face his operating bench at the same time.

VIEW IN TURBINE ROOM, MARION STATION DURING CONSTRUCTION

The generator supply to each bus is controlled by an oil circuit-breaking switch, also with remote control, and which has the auxiliary time limit and reverse-current relays in circuit for protecting the generators and system. From the bus-bars the current passes to the floor above by separate cables, each being in circuit with an oil switch and connecting to the feeder circuits. Each circuit from a generator has two mains, one of which can be connected to an adjacent sectional bus, which are, however, kept normally closed by clip switches.

The feeder circuits pass downward through ducts to the basement and fan into a series of pull boxes and thence to the cable wall and underground conduits, each being protected by General Electric lightning protectors, which also take care of any unusual rise in voltage.

Current and potential transformers supply the instrument on the panels near the operating board, so that only low voltage is in the vicinity of the operator. The current transformers also operate the automatic control of the circuit-breaking switches.

The cables are insulated with rubber coverings, except when they are a continuation into the building from underground. In these cases the cables are rubber core with paper insulation, protected with lead covering. The cables pass into cable bells on the second floor, each of the three leads being carefully brought away from each other and taped, and the bell filled with insulating compound.

All the current from the exciter sets is brought to the low-tension board on the operating floor and distributed and controlled from there.

A novel feature in the equipment of the switch and cable building is the 100-kw General Electric motor-generator set consisting of three machines. There is an a. c. synchronous motor of 600 volts, 25 cycles, supplied by static transformers stepping down from 13,200 volts. On the same shaft is a d. c. 125-volt and a d. c. 500-volt machine, both interchangeable as motors and generators by a method of switching.

The purpose of this special set is to obtain any possible desired current for testing work. It is possible to take trolley current and generate a. c. 600 volts or 13,200 volts for testing, or use 125 volts d. c. for exciter current or for lighting the station. Driving by the a. c., the 500 volts d. c. can be used for operating the coal handling or the crane motors. Or it is possible to drive the set with 125 volts d. c. from an exciter and use either 500 volts d. c. or 600 or 13,200 a. c. for testing.

The operation of this station will greatly relieve the heavy demand for energy on the other central stations of the corporation and provide a reserve in case of accident to any of the plants. In an early issue will be published additional details of the power generation and distribution on the Public Service System.

Special mention should be made of the courtesy received from Dudley Farrand, general manager; James T. Whittlessey, chief engineer, and Mr. Vassar, assistant engineer, for the facilities and information afforded in the preparation of this article.

ELECTRIC RAIL-WELDING IN CAMDEN

A considerable number of the visitors to the Philadelphia convention last October crossed the river to Camden to visit the system of the Public Service Corporation in that city, and also to inspect the electric welding of joints which was being carried on at that time. During the last few months the Lorain Steel Company has been completing a contract for the electric welding of 3087 rail-joints on the South Jersey division of the Public Service Corporation. About one-third of these joints were in the city of Camden proper, while approximately the other two-thirds were on the Haddonfield and Moorestown divisions of the company. In Camden a portion of the rail, as shown in Table II., is laid in asphalt, with Belgian block along the rail, a part in brick and a part in macadam. On the other two divisions all of the track was in macadam. On these two latter divisions a high-speed interurban service is run. The work has been carried on under the direction of P. Ney Wilson, supervisor of the company, and the result of the electric welding, according to the company, has shown a marked improvement both in the riding qualities of the track at the joints and also in ground return.

All of the joints welded were in a more or less battered condition, so that the joints had to be raised before being welded. This was done by raising the receiving rail so that the lowest point in this rail was level with the head of the abutting rail, after which the elevations were ground off with a corundum wheel. It has been found that the electric weld holds the rail absolutely firm and that the rolling of wheels across the joint since the work was finished has tended to make the joint smoother than it was immediately after the welding. It is true that by grinding off a portion of the head of the rail some of its wearing qualities are sacrificed. The experience at Camden, however, has been that this is necessary and that the battered end of the rail must be ground level before a good joint can be obtained.

Table I. shows a summary of the cost of electrically welding these joints, including contract price of $5.25 per joint. Table II. shows the cost per joint, type of paving, type of rail section and number of joints welded on each of the five streets on which the work was done. As will be seen from these tables, the cost per joint varies from $6.632 to $10.438, with an average of $7.635. This price, however, should be considered in connection with the maintenance charge of the joint with which this price is compared. Mr. Wilson, for example, estimates that the life of the welded rail on the Haddonfield Pike will be eight years, whereas during the last two years with angle plate joints this track has cost the company about $1 per joint each year for tightening bolts and shimming. This maintenance work has only temporarily relieved the situation, for each year the joint has been worse, and it was estimated that at the end of four years the rail would have been so bad at the joints that the track would have to be relaid. In other words, it is expected that in this particular case, by electrical welding, the life of the rail will be practically doubled at a less cost than would have been required simply for maintaining angle plate joints during the life of the rail.

TABLE I.—COST OF ELECTRICALLY WELDING 3087 JOINTS IN CAMDEN, N. J.

Cost of labor	$7,031.24			
Cost of material	581.09			
		$7,612.33		
Credit from sale of old fish-plates and bonds.		2,816.59		
			$4,795.74	
Cost of welding 3087 joints, at $5.25 each			16,206.75	
Cost of replacing asphalt, 899.6 yds., at $2.53; 117 yds., at $2.51			2,569.65	
Total cost of operation				$23,572.14
First cost per joint, labor				2.277
First cost per joint, material				.188
First cost per joint, labor and material				2.465
Cost per joint, labor and material, after credit is deducted				1.553
Final cost per joint, all labor, material, welding and asphalt charges				7.635
Cost per mile, under similar conditions, 30-ft. lengths				2,687.52
Cost per mile, under similar conditions, 60-ft. lengths				1 343 76

TABLE II.—COST PER JOINT, PAVING AND RAIL SECTIONS ON THE DIFFERENT STREETS

Haddonfield Pike, 7-in. girder (P. S. Co., section No. 238 and Cambria No. 824; rubble stone on sand, 989 joints		$6,684
Moorestown Pike, 9-in. girder and 7-in. girder (P. S. Co. sections 238 and 200); rubble stone on sand, 1128 joins		6,704
Broadway, 7-in. girder (P. S. Co. section No. 238), asphalt between rails and part of shoulder, Belgium block along rail, on 6-in. concrete, 715 joints; Kaighn Avenue, 7-in. girder (P. S. Co. section No. 238), bricks between rails and shoulder, on 6-in. concrete, 64 joints; total, Broadway and Kaighn Avenue, 779 joints		10,438
State Street and River Road, 7-in. girder (Cambria section No. 834); rubble stone on sand, 191 joints		6,632
Total	3087 joints,	7,635

Santa Ana, Cal., did elaborate honor to Henry E. Huntington on Nov. 22, the occasion being a formal celebration of the opening of the magnificent new line of the Pacific Electric Railway Company between Los Angeles and that city. Flags, banners and bunting were everywhere in evidence. Many stores were decorated with the national colors, and on thoroughfares everywhere flags were strung from house to house. The parade presented the finest pageant ever witnessed in Orange County. The opening of a strictly modern standard-gage electric railway over 30 miles long with metropolitan service marks the beginning of a new era in the progress of one of the richest and most promising sections of Southern California, which has proved to be rich in splendid possibilities for freight and passenger traffic. There were many floats in the parade, harmonious in the plan of representing the leading industries of Orange County. Peanuts, honey, small vegetables, potatoes, celery, sugar beets, dried fruits, walnuts, apples, peaches, raisins, alfalfa, oranges, red chili peppers, poultry, peat fuel and dairy products comprise a list of the leading industrial activities of the county. Old soldiers in the parade cheered Mr. Huntington, and an elaborate banquet was tendered him in the evening. Following the parade in the forenoon, William E. Dunn, of the law department of the Pacific Electric Railway Company, respondeded happily to an address of welcome for the city. It is estimated that the railway company handled between 15,000 and 20,000 people for the celebration of the most eventful day in the history of Santa Ana.

EXPERT REPORT ON SAN FRANCISCO'S STREET TRAFFIC PROBLEMS

The Merchants' Association of San Francisco some months ago engaged William Barclay Parsons, of New York City, the eminent authority on traction facilities for cities, to investigate the traffic conditions in San Francisco and recommend a general plan for the development and improvement of the city's transportation and street traffic arrangements. Mr. Parsons, in his report, outlined a broad scheme for substituting the overhead trolley for cable on all of the street railway lines, and recommends tunneling under the peaks of the hills where necessary to avoid grades in excess of 14 per cent. He does not believe the city as yet needs a subway. With the report is included an ingenious scheme for terracing the roadways on certain streets, so as to make them accessible to horse-drawn vehicles. Mr. Parsons prefaces his report with the statement that his opinion had been asked regarding four "main points" or questions, which were framed in the following language:

"First—As to the desirability of constructing a subway in this city for taking care of the future street travel, and the time when such subway should wisely be commenced—reviewing the situation with a view to the future growth of the city, which, it is anticipated, will be very rapid.

"Second—Should the subway be built upon Market Street only, the place where the congestion now most shows itself, or should it be built with branches to cover a more extended territory?

"Third—What, in your opinion, is the proper system to be used in rebuilding the Sutter Street line, if done to-day, without regard to future subways or a single complete system?

"Fourth—If the city desires to undertake the operation of a line of its own on Geary Street, what system would you recommend? The chief desire of the Merchants' Association is to know what is the most perfect and comprehensive system which can be adopted for the greatest convenience of the traveling public of the entire city, including, if you choose, a recommendation for all lines in the city.

"The Merchants' Association has heretofore stood firmly opposed to overhead wires in business districts, and in renewing any of the present branches or existing lines believes none but the best possible system should be adopted."

The report then continues:

San Francisco is a city on the end of a peninsula which has a width, from the Bay of San Francisco on the east to the Pacific Ocean on the west, of about 7 miles. The present limits of the city, which are formed by the water front on the east, north and west, and by the county line drawn straight from east to west on the south, give it a rectangular form, with an area of about 47 sq. miles.

PRESENT CONGESTION OF CABLE CARS AT FOOT OF MARKET STREET, SAN FRANCISCO

Topographically, the surface of San Francisco is much broken. One main ridge extends north and south substantially in the center of the peninsular, the peaks of which in many places have an altitude of 800 ft.. At the northeastern corner of the city there is a sharply marked rise known as Nob Hill, whose elevation exceeds 300 ft. To the east the surface falls away rapidly to about Dupont Street, while on the west the ground first descends and then rises on the eastern flank of the main ridge.

The eastern portion of the city, especially immediately south of Nob Hill, is practically level, and the extreme western side lies on a comparatively uniform slope on the western flank of the main ridge.

In the original plan of the city it was unfortunate that the striking features of the local topography were disregarded, and that streets were located without reference to gradients. Market Street, the largest thoroughfare, however, beginning at the water front and running southwesterly, skirts the southern extremity of Nob Hill, and is nearly level for a distance of about 2½ miles, when it begins to rise. It is now, and of necessity must always continue to be, the main artery of travel in San Francisco. North of Market the streets have been laid out on a rectangular plan, running nearly north and south and east and west, and making angles of about 45 degs. with Market Street. To the southeast of Market the streets are also rectangular, but parallel with and at right angles to it.

WHERE GROWTH CAN BE PREDICTED

The topography and the layout of the streets fix the commercial and residential portions of the city. Commerce cannot, and consequently will not, follow streets which have gradients so steep as to be impossible or inconvenient for ordinary dray and wagon delivery. San Francisco may therefore expect to see the retail district follow the general line of Market Street and the streets immediately adjacent thereto on the north so far as the gradients are of a moderate inclination. The area lying to the southeast of Market Street and extending directly to the water front will probably be the wholesale territory, while the district north of Market Street and to the east of Nob Hill will continue to be, as it is at present, the financial center.

Portions of Nob Hill are now the location of some of the finest private dwellings in San Francisco, and on account of the view which the eminence affords, this site forms a most admirable one for such use and for still further development. Unfortunately, other parts of Nob Hill are given over to the Chinese quarter and buildings of an undesirable character, as the excessive street gradients make it impossible to convert such territory into dwelling areas of the best type. The present residential district of Nob Hill is small, and while it is capable of being increased by removing the existing objectionable gradients in a way that I shall point out later, it is only large enough to provide sites for a portion of the better class of residences.

THE NEED OF TRANSPORTATION

At present the territory which lies to the west of Nob Hill, to the north of Golden Gate Park, and to the south of the Presidio Reservation, is being covered by dwellings of high quality. Already a great part of this area is solidly built over, leaving the only territory open to a great development for residential districts, within the limits of the municipality, that toward the south and southwest. If such local extension is hindered by lack of interurban communication, the suburbs across the bay will receive an increased stimulus and will serve as dormitories for the future population, who will be carrying on their daily vocations within the city proper.

The population of the city, as officially counted by the Federal census of 1900, is 342,782. The local school census taken at previous and following five-year periods has served, when compared with the Federal census, to closely approximate the population as it stood in 1895, five years before the Federal census and five years after, in the present year. At these three periods it can be stated that the population has been and is as follows:

1895	332,000
1900	342,782
1905	432,000

The great development that has taken place during the past five years, which is very evident to one who visits the city at intervals, is shown by the above table.

DENSITY A LARGE FACTOR

In the matter of local transit, it is not so much a question of serving a total population as the serving of relative densities of population. From tables given in the report it is shown that the density varies between the maximum in district 43,

MAP SHOWING COMPARATIVE DENSITIES OF POPULATION IN SAN FRANCISCO

with 309 persons residing in each 100,000 sq. ft., to the minimum in the greater part of district 36, where there are but 3 persons per 100,000 sq. ft.

In order that the figures may be presented visually so as to give a better means of comparing totals than by a statement of figures, a map has been prepared and attached hereto, indicating by different degrees of shading the densities of population as they exist in the present year. The map shows the number of people residing per 100,000 sq. ft. of area (2.3 acres).

STREET RAILWAYS OF SAN FRANCISCO

The local transit systems of San Francisco are owned by four companies, whose names, together with the total miles of route of single track, are as follows:

Name	Miles of route	Miles of track
United Railroads	138.55	260.33
California Street Railway	5.37	10.74
Presidio & Ferries Railway	4.63	9.01
Gear Street, Park & Ocean Railway	4.13	8.26
	152.68	288.34

It is understood that the franchise of the last-named company has expired, and that the company is continuing in operation by temporary sufferance on the part of the municipal authorities; but it is not necessary for me to enter into a discussion of this question. This report will therefore continue to regard the Geary Street, Park & Ocean Railway Company as an actual organization.

The above track mileage is operated by four different methods, electricity, cable, horse and steam, as follows:

Name	Electric	Cable	Horse	Steam	Total
United Railroads	204.72	52.19	3.42	....	260.33
California Street R'y	.....	10.74	....	....	10.74
Presidio & Ferries R'y	.....	6.00	1.76	1.25	9.01
Geary Street, Park & Ocean Railway	.....	8.26	....	....	8.26
	204.72	77.19	5.18	1.25	288.34

The traffic on these lines is increasing even at a higher ratio than the growth of population, as is always the case in a city whose commercial activity increases with the population. The fiscal years of the companies do not exactly agree, and it is therefore impossible to give the exact number of passengers carried, nor is it necessary to do so, because for such an investigation as this the approximate totals suffice. It may be said, therefore, that all companies are now carrying paying passengers, exclusive of transfers, at the following rate per annum:

United Railroads	137,500,000
California Street Railway	8,650,000
Presidio & Ferries Railway	3,850,000
Geary Street, Park & Ocean Railway	3,970,000
	153,970,000

In addition to the above there are more than 40,000,000 passengers per annum who find it impossible to continue the journey by single car, and who receive transfers from the various lines as follows:

United Railroads	38,500,000
California Street Railway	1,600,000
Presidio & Ferries Railway	1,600,000

HOW THE TIDES OF TRAVEL MOVE

As an analysis has been made of the distribution of the population of San Francisco, so it will be interesting to make an investigation of the traffic on the surface lines. Taking Market Street as the backbone of the city, of the total paying passengers carried on the street railroads, amounting to 154,000,000 per annum, 92,400,000 passengers are carried on the lines running to points north of Market Street, including such lines as McAllister and Haight Streets, which run on Market Street as well as on streets north of it. Similarly, the lines that lie south of Market Street, including those of Castro and Valencia, carry 61,600,000 passengers.

In the former system of railroads there are 78.76 miles of route and in the latter 81.31 miles, including a repetition of the mileage on Market Street according as it is used jointly; so that the number of passengers carried per mile amounts to 1,174,700 in the former case and 757,600 in the latter. The traffic, therefore, on the northerly system, as compared with the traffic on what we may call the southerly system, is in volume in the ratio of 3 to 2. From these figures it will be seen that while one part of the city has a volume of traffic somewhat greater than the other, the difference is in accordance with the variations in population, and indicates no decided trend in either direction.

The details agree with this general conclusion. Thus, the McAllister Street line, the one of the greatest travel in San Francisco, has a density of about 2,000,000 passengers per route-mile, or about twice the average for all the lines in the city. This difference between the maximum and the average is unusually small and indicates a general distribution of travel. While such distribution is a public convenience as avoiding excessive congestion, it shows the lack of any great traffic route, the volume of travel on which calls for, or would make profitable, an extraordinary outlay of capital.

The Market Street system is made up of five different lines, all of which originate at the ferry, run along Market Street and diverge from it at McAllister, Hayes, Haight, Valencia and Castro Streets. In addition to the through lines there are five that come to a dead-end terminus at Market Street. Omitting any interchange of passengers between the California and Geary Street companies with the United Railroads on Market Street, 50,000 passengers are compelled to transfer daily between the Market Street cars and those of the five tributary lines. This is a great inconvenience to the public.

As to passengers coming to and going from San Francisco, the Southern Pacific Railway Company delivers at its station on Third Street, and the same company, together with the Santa Fe Railroad and the Key Route, deliver at the ferry houses at the foot of Market Street a steadily and rapidly increasing number of suburban passengers. Such travel at the present time is substantially:

Southern Pacific Railway	1,600,000
Southern Pacific Ferry	20,700,000
Santa Fe Ferry	350,000
Key Route Ferry	5,300,000
	27,950,000

Of this total, about 25,500,000, or, say, 90 per cent, are suburban passengers, carried to and from San Francisco at the rate of about 70,000 daily.

The existing railway system of San Francisco has two striking features: First, diversity of methods of operation, in which respect it is unique among the cities of the United States; and second, that it still retains the use of horses, as does no other city in the United States except New York. San Francisco also continues to use the cable, while in the other cities of the country it has long since been discarded, or efforts are being made to do so.

ESSENTIAL REQUIREMENTS OF GOOD STREET CAR SERVICE

The maximum efficiency is rendered by a transportation system when the methods of operation are reduced to the simplest form with absolute uniformity.

It is obvious that the greatest convenience to the public will have been realized when a passenger can take a car at any point and go to his destination on the same car without the annoyance and delay of transferring. Such an ideal arrangement is not capable of entire realization, but any break in the operating arrangement places an additional difficulty upon its accomplishment.

In the present state of the art of transportation, electricity is the most satisfactory means of applying power; it is clean, elastic, capable of producing high speed, easily controlled and economical. Steam as a power should not be permitted within a city's limits; horses are thoroughly inefficient; while the cable lacks elasticity and is defective in speed. The unfortunate street gradients of San Francisco have apparently demanded the continued use of the cable, although it has been abandoned in other cities. Horses and steam can be easily removed; and they should be removed, promptly. It will be seen, as will be shown later, that the cables are not as necessary as they have appeared to be, and that they, too, can be made to give way to a superior form of operation. I shall therefore recommend to your association the abolition of all forms of motive power except electricity as the most radical and fundamentally far-reaching improvement that can be made to your local system.

Believing that the method of operation for the sake of the traveling public should be of one type, so as to give it the highest elasticity, I shall couple the above recommendation with the further one, that one system of electrical operation be adopted and made uniform throughout the city. The question, therefore, at once arises, how should the electricity be applied, whether by storage battery, by conductor bars laid in conduits, or by overhead trolley? Other methods have been tried, but nowhere as yet have experiments been on a sufficiently large scale to warrant generalization. The answer to this question will dispose of the third and fourth heads in the letter of instructions as given in full at the beginning of this report.

The above three methods of application in electricity have all been tried. The storage battery has been given an extended experimentation, but as at present constructed, or with even such means as now seem possible of application, there is nothing to justify its use; and the possibility of so doing may therefore be disregarded, at least until such time as some radically new form of battery is devised.

HISTORY OF THE UNDERGROUND CONDUIT

Operation by conduit has been tried in three cities: first, in Boston, where it was a complete failure, and where the conduits were taken up and replaced by overhead trolley; second, in Washington; and third, in New York. The adoption of the conduit system in the second-named place was the result of an accident. The Washington railroads were formerly all operated by cable, the sub-structure for which, including the tracks, had been laid in the most approved manner, all properly subdrained. The main power house of the operating company was destroyed a few years since by fire. As the company did not desire to reinvest its capital in a means of operation that was confessedly ineffective and expensive, and as the Federal authorities would not permit the use of overhead wires, and further, as the conduits had been so well built that it was only necessary to remove the cable and place within the conduits the conductor bars and necessary electrical connections, it was decided to equip the lines as a whole for conduit operation. The very important feature is to be borne in mind, in this connection, however, that the work was done, not on individual lines, but on the entire system.

ORNAMENTAL SIDE TROLLEY POLES WITH ARC LIGHTS IN USE IN FRANKFORT

In the case of New York, the proposition to supplant horse operation by mechanical means was undertaken at a time when all the main streets and many of the less important ones were congested by a great mass of telegraph and telephone wires, which, together with their poles, the municipal authorities and the public generally desired removed. The position was then taken by the authorities before any work was done, that on no account would any more overhead wires be permitted. The company therefore introduced the cable on the important thoroughfares and retained the use of horses on the others until the method of conduit operation had been perfected.

This prohibition of overhead trolley wires covers only that portion of the city of New York now known as the borough of Manhattan. In the other portions of the city, which form the greater part of the total area, and which include at present about one-half of the population, no prohibition of overhead trolley wires has even been proposed, and all the railroads in such districts are operated by means of them. The railroad systems of the city of New York are divided as follows among the several means of operation:

	Miles of Track
Overhead trolley	870.11
Conduit trolley	212.49
Horse	99.74

The new work on conduits is practically limited to the conversion of horse lines in Manhattan, of which only 5.4 miles are in hand at present, while of overhead trolley 15 miles are actually in progress, with 35 miles projected.

In connection with New York, it is exceedingly important to point out, that while there is a large amount of trackage operated by conduit trolley, the spirit of uniformity has been strictly maintained, and this system is confined solely to Manhattan Island. There is no effort on the part of the company to introduce the use of overhead wires in the district now covered by the conduit lines; and the horse lines which are confined to that same territory are gradually being reconstructed to conduit operation, except on those streets located near the water front, where high tides would be apt to flood the conduits and thus prevent electrical operation. In like manner, in the districts where the overhead trolley is the sole method of operation, no effort is made to make a change. Although the use of the overhead wire is generally prohibited on Manhattan

STREET IN DARMSTADT, SHOWING METHOD OF ATTACHING TROLLEY WIRES TO BUILDINGS

Island, this prohibition is elastic and does not extend to prevent the overhead trolley cars from the borough of the Bronx crossing the Harlem River and going to their points of destination in the upper part of Manhattan Island, nor to prevent the trolley cars of Brooklyn from crossing the bridges over the East River.

OBJECTIONS TO THE CONDUIT

With the exception of Washington and New York, no other city makes any use of conduit operation, and for two reasons: First, its adoption as part of a going system of railroads means the introduction of a new factor in operation and a breaking of uniformity; second, the operation of the conduit is known to be both expensive and as involving the possibility of annoyance and delay not present with the overhead trolley. The conduit slot is easily blocked by extraneous substances or flooded by water. Pieces of hoop iron may fall through the slot and by making short circuits cause not only serious delays, but often considerable physical damage. In the event of such accidents, the delay in making repairs is more serious than with the overhead wire. One-third of the delays on the conduit system of the surface street railroads of New York are due to accidents to the conduits. It would seem that it is only practicable to introduce the conduit economically when it can be done as in Washington—that is, after the result of an accident and under the extraordinary condition that nearly all of the underground work had been about completed; or second, as it was done in a portion of New York, where no other form of electrical operation had been introduced.

In respect to conduit and overhead systems, European practice is similar in principle to that described above. Although some electrical conduits are to be found in a few of the larger capitals, the amount of such work is comparatively insignificant, even in London, Paris and Berlin; while cities like Glasgow, Liverpool, Manchester and Hamburg have completely unified their systems with the overhead trolley. In all such cases the cities are larger than San Francisco, with narrower streets and with far greater congestion of traffic. The compelling reason is that better operation is secured and better results obtained for the same capital expenditure. Overhead trolley construction is the generally recognized standard. Experiments along various lines are in progress to develop a method of supplying power that will retain the advantages of efficient operation without the use of overhead wires, and it is possible that some such method may be successfully devised; but it will be many years before any system of this kind will be considered an approved success.

THE USE OF THE OVERHEAD TROLLEY

If the street railroad system of San Francisco did not exist, or if the Geary Street and Sutter Street lines were the only ones constructed, it is not even then certain that I should recommend that they be reconstructed for conduit operation. It would be better to take the amount of capital that the additional cost of conduit construction would represent and apply it either to the building of additional lines or to the improvement of the existing lines in the way of new equipment; because with a growing city it is often of great advantage to its development to have the transportation companies adopt a vigorous and aggressive policy in the way of extensions into new and sparsely built districts. Such a policy may readily be expected from corporations using the overhead trolley system.

SPAN WIRES ATTACHED TO BUILDINGS IN COLOGNE NEAR THE CATHEDRAL

There are many lines in all of our large cities which have built up their tributary districts to a high degree of density by pushing new trolley lines into virgin territory, and thus in a way testing the district. This is a good policy and one that is quite practicable with the overhead trolley construction; but, with the excessively expensive conduit system, it can never be justified, as the roads would go into bankruptcy before the country had time enough to grow up to the facilities.

The Geary Street and Sutter Street lines form but a small portion of the total mileage, and as it is impracticable from both the legal and financial standpoint to reconstruct the whole system of San Francisco railroads for conduit operation, it would seem to be a mistake to build conduits on the two lines in question and so introduce another discordant element and place another bar in the way of entire operating unification.

Some two years ago the British Government appointed a special Royal Commission to investigate the matter of local transportation in London. This commission appointed a board of three engineers (in which number I had the honor to be included), which reported to the commission, by whom it was sustained, strongly urging, for what is known as the metropolitan area of London, the necessity for a complete unification of the local lines and the extension of the tramway system by overhead trolley. Although the conduit method of operation was recommended for a very limited section in the central portion of the city for reasons peculiar to London, and in a district where no tramways exist at present, it was urged that such construction be rigidly restricted to this central area, and that all lines outside of that section be operated with the overhead wire, on the ground that such operation was more successful, and that the additional capital would be better spent in new lines.

It is this latter advice, which was considered applicable to London with its population of nearly 7,000,000, its enormous congestion of street traffic, its narrow streets and its great wealth, that I now beg leave to repeat for your own city.

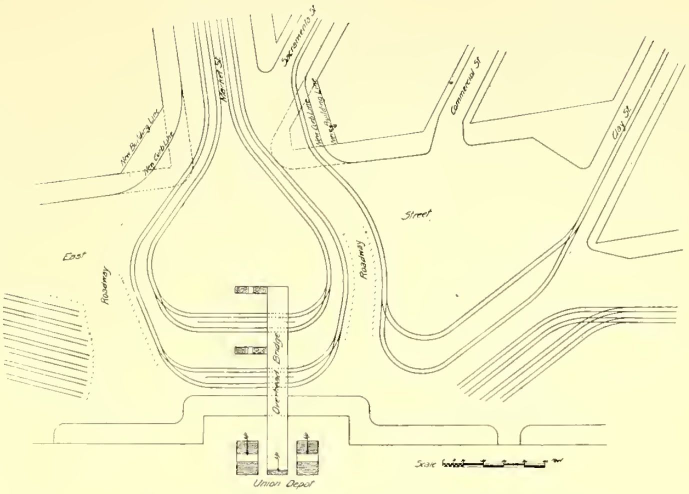
RELIEVING CONGESTION ON MARKET STREET

The number of passengers entering San Francisco from the ferries, a number which is steadily increasing, indicates the desirability of having as many lines as possible reach this point of passenger origin so as to reduce to the minimum the necessity of transferring from one line to another. The existing facilities cannot be improved as long as the tributary lines are

ORNAMENTAL CENTER-POLE CONSTRUCTION IN COLOGNE

operated electrically, while those running on Market Street are cable. To properly improve the situation, the Market Street lines now operated by cable should be reconstructed into electric railroads, and the tributary railroads, such as California, Sutter, Geary, O'Farrell and Eddy, should run all or some of their cars along Market Street to the ferry houses.

At present the Market Street line can carry no more cars, not that the limit of carrying capacity of the tracks has been reached, but on account of the terminal arrangement at the ferry. The present cable cars at the ferry have to be placed one by one on a turn-table and reversed in direction. If the cable were discarded, the turn-table could be removed, and in its place could be substituted loops around which the electric cars could be run. This is the method employed for turning the trolley cars at the Manhattan end of the Brooklyn Bridge, where 292 cars per hour are handled, with a total annual passenger travel of 110,000,000, which is about four times that of



SUGGESTION FOR TERMINAL LOOPS AT MARKET STREET FERRY

the total travel of the San Francisco ferries, only a portion of which, it must be remembered, takes the surface cars.

A plan is given which can be taken as a suggestion, in principle, of the ferry terminus. There are four different systems terminating at this point. The Mission Street and the other lines from the south have now a series of stub ends, which for the moment give reasonable results. The same is true of the Union and Broadway lines from the north. The Sacramento and Clay Street lines are united by means of a turn-table. If these lines were electrified a loop should take the place of the table.

It is with the Market Street lines that there is the most trouble. The four tracks, on reaching East Street, should be divided so as to give two loops for each track on the Market Street line. These four loops would give accommodations for cars to stand and load in front of the ferry house and permit their movement without obstruction or delay, and without blocking Market Street. To avoid danger to persons walking across these loops and the congestion and delays incident to crowds standing upon the tracks, a broad bridge could be constructed from the upper level of the ferry house, with steps descending to the inter-track spaces.

The car interval on the two-track line of Market Street is at present thirty seconds. This interval is fixed by the capacity of the ferry turn-table. Broadway, in New York, a street narrower between buildings than Market Street is between curbs, and with a vehicular traffic much greater, now carries cars at a seventeen-second interval, while the cars upon the Brooklyn Bridge run at twelve seconds.

By putting in electricity, which permits higher speed than a cable, and what is of more importance, permits cars to make short spurts, and free themselves from congestion, a closer interval can be maintained on Market Street than can be maintained on Broadway, owing to a smaller volume of other traffic and a wider street. The introduction of the trolley on Market Street, therefore, would about double the carrying capacity of the street. The existing congestion on Market Street occurs between California Street and the ferry, where, during the busy hours from 5 to 8 cars are blocked, from which the passengers usually alight some distance from the ferry and walk to save time. With the proposed loops the cars would run direct to the ferry plaza, and thus free the street, not block each other, and save many passengers an unnecessary walk.

THE PROPER TREATMENT OF TROLLEY POLES

In reconstructing the Market Street line, I am keenly alive to, and sympathize with, the objection of the city authorities to the erection of poles in streets like Market Street, where they do not now exist, and even in streets where they are already in place. In suggesting the reconstruction of the Market Street line, I do not recommend a reproduction of the present overhead construction with its multiplicity of poles and network of feed-wires. The construction that exists, while strong and substantial, and similar to the overhead usually found in American cities, is thoroughly unsightly, and occupies too much space. In the cities of Europe, where there is but little conduit construction, the authorities permit the use of the overhead trolley for the reasons that have been given above, great care being taken, however, to see that such overhead construction is made as attractive as possible. The poles are designed according to artistic standards, and arrangements are made to combine lights with the overhead work so that one pole serves for both purposes. As illustrating European practice, there are here submitted photographs of streets upon the Continent, showing the construction of overhead work in a manner somewhat similar to that recommended in this report.

Especial attention is called to the picture of a street in Cologne, where the suspension wire spanning a narrow street is attached to the buildings, with the beautiful Cologne Cathedral, than which there is no more beautiful structure in Europe, showing directly in the background. The same construction is shown in the picture of Darmstadt, where the trolley wires swing around the picturesque round tower, and yet do not at all mar the architectural effect. The other two pictures indicate the practical application of the suggested combination of trolley and light poles. The other picture of Cologne shows the center-pole construction, and indicates very clearly the few wires that are requisite, and their slight obstruction to the sky line. In a similar manner, the picture of Frankfort indicates the side poles with a suspension wire, and illustrates strongly the minimum obstruction caused by overhead wires. In all these cases it is evident that all feed, telephone and telegraph wires have been strictly forbidden, the presumption being that they are carried in sub-surface ducts, just as is recommended elsewhere in this report.

It is impossible to remove all poles from our city streets—we must have some for lighting—but there is no reason why San Francisco should not do as is done in Europe, and make the same pole serve for trolley wire, lights, street signs, and fire alarms and mail boxes. The trolley poles in San Francisco are now set at intervals of about 100 ft., with poles for lights and telegraph wires in addition. This is much closer than is necessary; if properly designed so as to give sufficient strength, they can be set at intervals of at least 200 ft., and probably 300 ft. Experiments in placing poles at such distances are now being made on some of the lines in New York, and that under climatic conditions of sleet and ice, which tend to break down the wires, that will not be present with you. If poles should be set at the longer interval, the copper wire should be suspended from a steel supporting wire by insulating attachments at intervals of 10 ft. to 15 ft., the result being not only better insulation, thus preventing the danger from leaking currents, but in case of broken wires the ends will be too short to reach the ground, and so will be prevented from becoming dangerous.

An interval of 300 ft., however, is probably too long for street lighting, and it is therefore recommended that the poles be placed at such intervals as the city authorities deem proper for lights.

On Market Street the poles could be placed in the center of the street between the tracks, which are now far enough apart to permit the running of the largest car used in San Francisco, with a row of poles between. These should be made with cross-arms carrying the two wires with a light between, and a suggestion for such a pole somewhat similar to European designs, but better adapted to American manufacture, is herewith given. This arrangement of lamps down the center will give an even distribution if light over the whole street surface. The existing light poles on the sidewalks can be removed, and the roadway will be no more obstructed than it is at present.

In narrow streets, where center poles are not possible, the overhead wires can be carried by a restricted system of poles with ordinary span wires from curb to curb, the poles being used for the support of both lamps and span wires and placed at the intervals considered proper for street lights. Under this arrangement the only additional obstruction will be the span and longitudinal trolley wires, which are almost insignificant. The span wires can be attached also in some cases directly to the houses, as is done in Europe, and in some streets in San Francisco. In order to prevent any possibility of vibration being transmitted to the houses, it is customary in Europe to interpose a layer of rubber between the house and the brackets, which has been found to be exceedingly effective. The designs submitted have been developed with the aid of Heins & La Farge, architects.

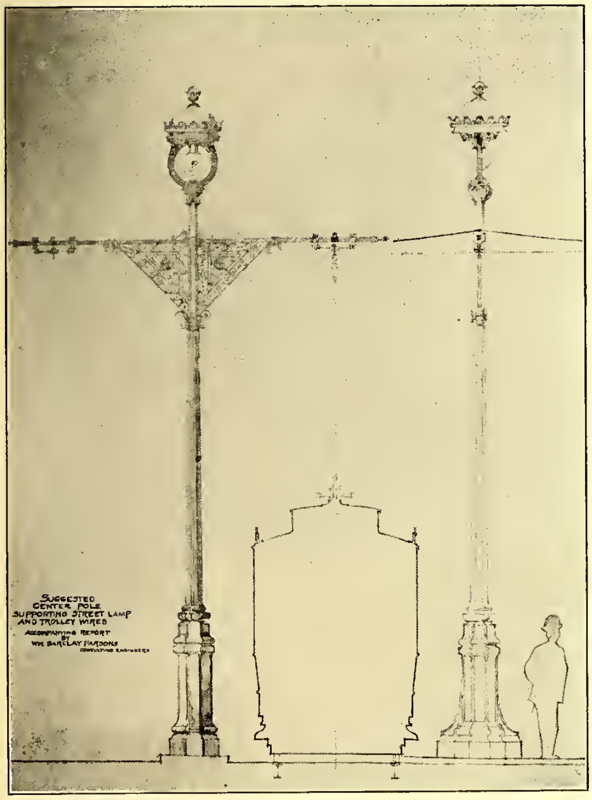
In some of the streets in San Francisco the feed-wires are placed in ducts beneath the surface. This should be done on other existing lines as rapidly as possible, and the requirements rigidly enforced on all new lines or old lines that are to be reconstructed, so that the street obstructions will be limited to the ornamental poles and the trolley and suspension wires.

MARKET STREET DOES NOT NEED A SUBWAY YET

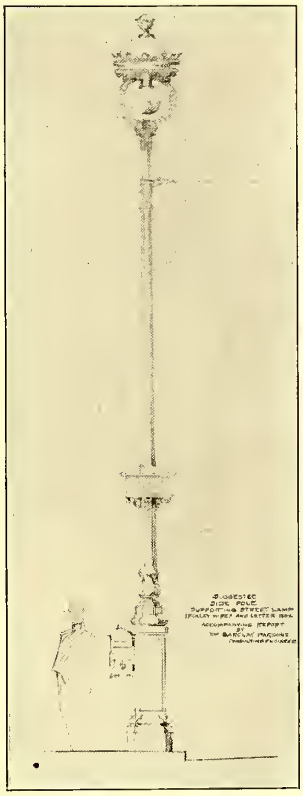
In the first and second headings of your written instructions you directed me to consider the possibility and propriety of constructing subways, primarily under Market Street. With the exception of the lower end of Market Street, where the ground has been filled, and where the present street surface indicates a strong tendency to settle, Market Street presents no extraordinary difficulties to subway construction. Between Montgomery Street and the ferry work would be expensive, and would require heavy piling in order to provide sufficient foundations. West of Montgomery Street a trench would have to be excavated, the existing sewers and other sub-surface structures reconstructed, and the streets repaved on top of the subway.

There are two kinds of subway, either one of which could be constructed on Market Street. The first would be according to the Boston principle, intended to take the surface cars. In Boston, the excessive congestion on Tremont Street, with a width between curbs of only 29.5 ft., as compared with 78 ft. on Market Street, necessitated the removal of the street cars, the interference of which with each other reduced their speed to about 2 miles per hour. The city of Boston constructed a subway at its own expense and then leased it to the street car company for operation on its completion. Such a subway could be constructed on Market Street, beginning, say, at Sansome Street and extending to Twelfth Street, which covers the portion of the city where the greatest volume of passengers is now handled. The cars could enter on an incline in the center of the street at either end, and these inclines could be so arranged, taking advantage of the triangles which widen Market Street at the points named so as not to cut off traffic crossing Market Street at a single cross street. The service of the surface cars on Market Street by this method would probably not be satisfactory to either the traveling public or the store proprietors along the street. Persons traveling in that part of the thoroughfare and desiring to alight at various points, frequently between the streets, and to watch the store windows, could not do so. If a subway were built there would probably arise a demand for a continuation or a revival of the surface traffic, which means that the capital invested in the subway would be practically lost.

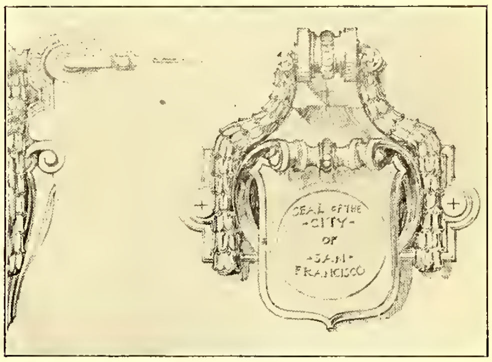
The second type of subway is the New York type, built as an independent railway and supplementary to the surface lines. A subway of this character, in order to be successful, must have sufficient length and a sufficient tributary population to make it pay. The minimum cost of a subway with two tracks through the city of San Francisco, with stations and equipment, will be at least $2,000,000 per mile. There is not to-day sufficient travel on any one route in San Francisco to pay the operating expenses and interest charges on any such capital investment. The route traversing the greatest territory of travel to-day would be a line starting from the ferry, then following some street like Geary, and extending to Pt. Lobos. The cash cost for such a line having a length of about 6½ miles, without construction profit, would be about $13,000,000. Interest on this sum at 5 per cent, which is moderate when the question of commissions, etc., taken into account, would amount to $650,000 annually, to which should be added, say, $200,000 for taxes and other fixed charges, giving a total annual charge of about $850,000. Assuming a rate for operating expenses of 60 per cent, there would be required $2,125,000 as gross receipts to pay the operating expenses and meet the fixed charges without allowing any profit from operation. At a fare of 5 cents this would mean a passenger travel of 42,250,000 per annum. In other words, one-fourth of the total travel on the whole of the San Francisco system of street railroads would have to be combined on the territory tributary to one street to make a subway pay. Even if a subway were built, all the traffic along the route would not be taken by it, because a large portion of the travel is purely local, moving for a short distance only, to which a subway would be of no benefit.



SUGGESTED DESIGN FOR ORNAMENTAL CENTER POLES FOR SUPPORTING TROLLEY WIRES



SUGGESTED DESIGN FOR ORNAMENTAL SIDE POLE FOR SUPPORTING TROLLEY WIRES



SUGGESTED ATTACHMENT TO BUILDINGS TO SUPPORT TROLLEY WIRES

It must be remembered that but one city in the United States has attempted the building of a subway supplementary to surface cars, and that is New York, where traffic conditions are of an extraordinary nature, and not duplicated in any city in the world.

For illustration and for comparison with the previously given statistics for San Francisco, it will be found that the average density of people per square mile in your city is 9190; in the borough of Manhattan, New York, it is 108,030, and while in San Francisco's most populous district the density is 309 per 100,000 sq. ft., there are sections in Manhattan where the density exceeds 1940. As for traffic, your railways show an average of 966,000 passengers per route mile per annum; the similar average in Manhattan, including the horse railways, is 2,400,000, and the greatest traffic line having 12,000,000 passengers per route mile, as against 2,000,000 passengers per route mile in McAllister Street, your heaviest line. The street railways in New York are also supplemented by the elevated and subway railways, the traffic on which is not included in the above. In Europe, where underground railroads have been built, the Paris line is the only one that has been financially successful. The most profitable railroad in London earns only 4 per cent, and the other lines still less, and this on a capitalization that represents actual cost value.

For short distances up to an average journey length of 2 miles to 3 miles, people prefer surface cars on account of the convenience of taking and leaving them at any point, and on account of greater speed when the time required to walk to and from stations is taken into account. A subway to be profitable must have either sufficient length to attract travel or must be fed at one extremity by converging lines and reach points of passenger concentration at the other, with a great density of population along the route. Such conditions in San Francisco will probably be met in the future by the development of the very desirable territory to the west and southwest. When the density of population is there sufficient, a subway under Market Street and the Twin Peaks, with branches to the west and southwest, will be the solution. One cannot look too far into the future, and it is suggested that no attempt be made to build a subway along Market Street until such time as the population will have reached the point both in numbers and density as to warrant a permanent decision as to what the proper location is to be.

CERTAIN TUNNELS ARE NEEDED

Although I can see no advantageous reason for building a subway under Market Street at present. I am of the firm opinion that subways should be built at once in other parts of the city where they are needed to-day. The suggestions made above call for the elimination of horse and steam, and of the cable lines on all streets except those where the gradients are so unusual as to prohibit the use of any other motive power than the cable. A properly constructed and equipped electric line can easily ascend gradients of 10 per cent or 11 per cent, and if the length of the incline be not too long, gradients of 12 per cent and possibly 14 per cent. In San Francisco there are many places where the street gradients exceed even the maximum limit. Taking streets on which railroads are now laid, there are many where the surface grade rises at a rate exceeding 14 per cent.

Of these streets, six cross Nob Hill. Passing them for the moment, the Hyde Street line requires a cable on account of the incline on Russian Hill, and on Jones Street for the block between Pine and Bush Streets. If the Hyde Street line were relocated at the northern end so as to avoid crossing Russian Hill at the center and were continued on Hyde Street southerly to Bush Street and thence to Jones, the excessive gradients would be omitted enitrely. The Hayes Street cable can be done away with by regrading the summit at Alamo Square at the intersection of Hayes and Pierce Streets, which would make the street gradients convenient for all traffic on both Hayes and Pierce Streets, and would be a decided benefit to the adjacent property. The Powell Street cable can be done away with by carrying the Powell Street line on Stockton, the adjacent street, from Sutter to Sacramento, and then continuing the Powell Street line on Powell Street from Jackson Street to Montgomery Avenue, thus avoiding the sharp hill between Union and Green Streets. The Castro line south of Twentieth Street would probably have to remain a cable line, and if the balance of the road were made electric a transfer could be made at Twentieth Street to surmount the hill beginning at that point.

For the elimination of the gradients on Nob Hill, I would suggest that the hill itself be tunneled, beginning on the west at the east side of Hyde Street and running to Dupont or Mason Street on the east. For the present two such double-track tunnels would seem to be ample, one located under California Street and one located to the north of it, under, say, Jackson Street, or such other street as may seem more desirable. Tunnels of this character cost less to construct than the accepted type of subway, for the reason that they are so deep as not to interfere in any way with sewers, water and gas pipes, thus saving the cost of removing and rebuilding such underground obstructions; and in the case under discussion, there would not be involved any additional cost for equipment, which, in the construction of underground subways, forms a very important item of the total cost.

The tunnel on California Street would extend from Hyde Street to Dupont Street, and have a length of 3290 ft., while the one under Jackson Street would extend from Hyde to Mason, and have a length of 1856 ft. With one station on each tunnel, such stations to be equipped with elevators, the total cost of the two tunnels would not exceed $1,200,000.

PERSPECTIVE PLAN, SHOWING SUGGESTION FOR TERRACING ROADWAY IN HILL DISTRICT, SAN FRANCISCO

These tunnels would have ample capacity for carrying all the cars now run on six lines. The present combined maximum schedules call for 120 cars per hour in each direction. If they were run through two tunnels it would mean an interval of 1 minute upon each track in each direction. This interval can be greatly reduced in tunnels, where there would be no interference. In these tunnels the California, Sacramento and Clay Street lines would be combined in the California Street tunnel; and the Union, Jackson and Washington Street lines in that under Jackson Street, suitable connections at both ends of the tunnels being arranged to restore the various services to their respective routes. In order to serve the population on top of Nob Hill, stations should be constructed in the tunnels and equipped with elevators and staircases running from the platforms to the surface of the streets. If two tunnels were built these stations could be placed at alternate streets, so that traffic going north and south on Nob Hill would not have to walk more than one block in either direction to get a car at the terminal points or at intervening stations.

CABLES SHOULD GO

By means of these tunnels and the relocation of small portions of the Hyde and Powell Street lines and the regrading of the Hayes Street line at one point, San Francisco can do away with the antiquated cables and adopt in such streets an improved form of traction that will give a higher speed than is now possible, and so reduce the time of transit from, say, Sansome Street to the Golden Gate by at least 15 minutes. An inspection of the population map will show at a glance that the improved service would reach the district most in need of it, and where the greatest volume of traffic originates. It will also furnish a decided measure of rapid transit to San Francisco's great pleasure resorts, the Golden Gate Park and the ocean beach at the Cliff House, and to the rapidly growing district lying north of the park. This seems to be the portion that for the moment first requires an increase of facilities.

In this discussion I have followed the suggestion contained in your letter of instruction, and have disregarded differences in line ownership, and have treated the several systems as capable of being combined, at least for mutual benefit in operation.

TERRACES AND WINDING ROADS FOR THE HILL DISTRICT

The report then outlines a comprehensive scheme for opening up several of the hill streets now too steep for vehicle traffic by running the roadways up the grades in a series of winding inclined terraces on gradients that will enable horses to climb and descend easily, and permit wagons to stop in front of every house. Many of these houses have never had a wagon in front of them, but deliveries are made from the cross streets above or below. In conjunction with the plan for terracing the roadways, the report includes a scheme whereby the sidewalks would be reconstructed to the new grades, and to compensate for the difference between the gradients of the various terraces, short flights of easy stairs would be introduced, as shown in the perspective sketch reproduced in this connection.

The report concludes with the following summary:

First—The transportation system of San Francisco should be made uniform with the greatest elasticity of operation, and to this end cables, steam engines and horses as motive power should be abolished, and one system of traction should be introduced.

Second—Taking into account the present state of the art, the fact that the greater part of San Francisco's railways cannot be otherwise changed, and for operative reasons, this system is the overhead trolley.

Third—That arrangements should be made to extend the railway system to parts of the city not now equipped with railways so as to make place for additional population within the city limits.

Fourth—That all new trolley lines be built with overhead construction greatly superior to that now in use in either San Francisco or other American cities so as not to disfigure the appearance of the streets, and all feed-wires be placed under ground.

Fifth—That for the present the construction of a subway on Market Street be postponed.

Sixth—That two tunnels be constructed under Nob Hill, permitting the removal of the cable lines, and that such tunnels be built by the street car companies or by the municipality and leased to the companies.

Seventh—That one or more inclined terraces be constructed on the eastern slope of Nob Hill, so that horses with wagons or carriages may ascend and descend freely.

The Lowell & Fitchburg Street Railway Company has petitioned the Massachusetts Railroad Commissioners to issue $240,000 5 per cent 20-year bonds to defray the cost of its road and equipment.

THE NEW EMPLOYEES' THEATER OF THE EAST ST. LOUIS & SUBURBAN RAILWAY COMPANY

The subject of supplying means of entertainment and instruction to employees is receiving more and more attention from managers of properties employing several hundred men. Reading rooms, billiards, bowling, etc., are now not uncommon adjuncts of modern car houses and shops, but the East St. Louis & Suburban Railway Company seems to be the first to provide a fully equipped, though small, theater for the use of its employees. The conductors' and motormen's room at the shops in East St. Louis was a room about 30 ft. x 75 ft. in size. Back of this are the toilet and bathrooms. At this end of the room a 20-ft. x 30-ft. stage was built of regulation height from the floor with a movable section to its floor which is removed, when the stage is not in use, for passage way to the bath and toilet rooms. By the use of a screen at the back of the stage the washroom becomes a very acceptable dressing room for the use of performers. All the requirements of a modern stage in the matter of footlights and other light effects have been supplied, as well as suitable flies, scenery, drop curtain, etc. All material and a portion of the labor in building the stage and producing the light effects, etc., were furnished by the company, a large part of the labor, however, being contributed after working hours by employees of the line, machine and shop departments. The seating of the theater is with ordinary chairs, furnished by the company. On account of the enthusiastic assistance of employees in voluntary work on stage and settings, the outlay for the company has been comparatively small.

The theater has been named the "Winstanley Auditorium," because of the location of the shop and shed buildings in a section of East St. Louis commonly known as Winstanley Addition. Its management is vested in a committee of five, consisting of the general passenger agent, superintendent of transportation, master mechanic, purchasing agent and the president of the conductors' and motormen's local. This committee fixes rules for use of the Auditorium, dates of performances, etc. Any ten employees of the company desiring to give an entertainment will be given any open date. All entertainments are free of cost to the audience, which, however, is restricted to employees and their families. Admission is by ticket on account of limited capacity, the tickets being distributed by members of this committee and heads of departments, who make no distinction as to any particular class of employees, "first come first served" till tickets representing the capacity of the theater are all issued. To meet miscellaneous expenses of costumes, rent of piano, etc., the company places at the disposal of the committee a moderate monthly allowance, so that those directly connected with the preparation of entertainments will not incur even a small personal expense.

The interest taken in the project by the employees has proved very great. The first general entertainment was given Monday evening, Dec. 11, when the young ladies from the general offices gave a vocal and instrumental concert, followed by stereopticon, phonograph and moving pictures, under the direction of the manager of the local electric light company. Friday evening, Dec. 15, the engineer of maintenance of way and the roadmaster gave an exhibition of hypnotism and mind reading which would do credit to professionals. On Thursday evening, Dec. 21, "The Interurbans" gave a minstrel performance that was par excellence and had to be repeated the following evening for the benefit of those unable to obtain tickets for the first performance. Every available seat is occupied at each entertainment, and the theater promises to be a source of much genuine recreation and amusement throughout the winter season for employees of the company. The amount of latent dramatic, psychic and musical talent among the employees of the company was not appreciated till the little theater gave opportunity for its development.

THE TRAMWAY SYSTEM OF FALKIRK, SCOTLAND

A description was published in the issue of Dec. 9 of the Leith tramways. The town of Falkirk, which is not far from Leith, being close to the Firth of Forth and about equi-distant from Edinburgh and Glasgow, is also the possessor of a new electric system. Falkirk lies in the midst of a thickly populated district, and has for many years been a busy manufacturing center. The route of the tramways, which have recently been constructed, is a circular one, and comprises in all some

THE CAMELON SWING BRIDGE OPEN

7 miles of track. The general contractors were Bruce Peebles & Company, with J. G. White & Company sub-contractors for the track.

The rails, which are laid to a 4-ft. gage, weigh 90 lbs. per yard, and conform to the British standard No. 1 section and specification. They are laid in 45-ft. lengths on a 6-in. bed of 6 to 1 concrete. The joints are made with 24-in., six-bolt angle plates. The bonds are of the Neptune type, No. 0000 section, and the rails are cross-bonded at every 45 yds. The crossings and all special work are Hadfield's manganese steel. The radius of the sharpest curve is 48 ft. The route is hilly, but the grades are on the whole not severe, the worst being 6½ per cent for a length of about 300 ft.

The overhead construction is of the bracket-arm type on all sections, with the exception of about ¾ mile of span wire, which is supported in part by poles and in part by rosettes. There is no center-pole construction. The side poles are in three pieces, and stand 24 ft. high from the ground; the length of bracket arm varies from 8 ft. to 16 ft. The poles are of four classes, weighing, respectively, 1000 lbs., 1100 lbs., 1234 lbs. and 1400 lbs. The trolley wire is of No. 0000 section, and guard wires are used to some extent. The car house has six tracks, and at present accommodates eighteen cars, though there is room for more. Pits are provided beneath four of the tracks.

The cars, which number eighteen, are all single-truck double-deckers, without roof covers, and an illustration is presented to show the general type. Their dimensions are as follows: Length over fenders, 28 ft.; over all width, 6 ft. 6 ins.; wheel base, 6 ft., and gage, 4 ft. The electrical equipment was supplied by Bruce Peebles & Company, Ltd., and includes their most recent types of motors and controllers. A novel feature

STANDARD DOUBLE-DECK CAR CLIMBING A GRADE ON THE LINE OF THE FALKIRK & DISTRICT TRAMWAYS

has been introduced in the motors of this firm by providing the armature bearings with ring lubrication. A check is fitted above the ring to prevent its chattering when passing over switches. Ordinary pad lubrication is used for the axle bearings. The motors are rated at 30 hp each.

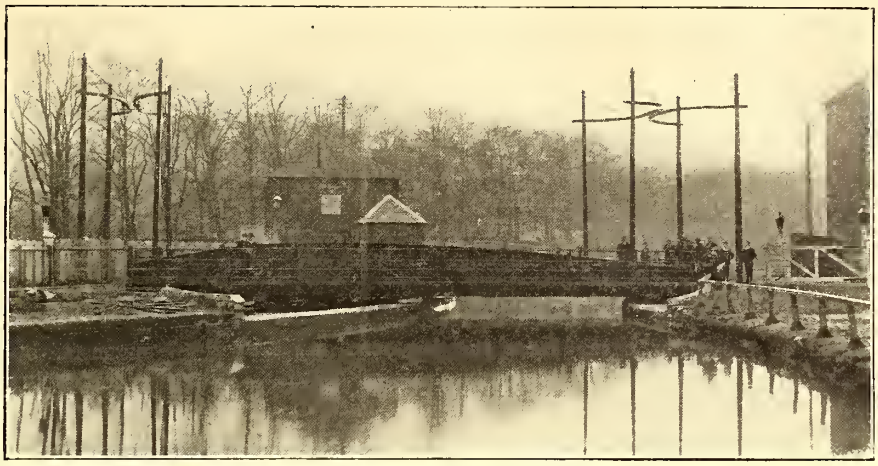
CAR HOUSE OF THE FALKIRK & DISTRICT TRAMWAYS, SHOWING IN PARTICULAR THE TYPE OF ROOF CONSTRUCTION

The controllers are of the magnetic blow-out type, and have four series, four parallel and six brake notches. Hand and rheostatic brakes are fitted to all cars.

The power supply for the tramways is obtained from the Bonnybridge station of the Scottish Central Electric Power Company, recently erected and equipped throughout by Bruce

Peebles & Company. The power is transmitted at 3300 volts, two-phase, 50 periods, to a sub-station, the interior of which is illustrated. The sub-station equipment includes two Peebles-la Cour motor converters, which are each of 200-kw nominal capacity, but each can readily take an overload of 100 per cent for short periods, so that at present one set can take the tramway load. Largely owing to the fact that they are wound twelve-phase, these machines are very stable in parallel, while owing to their special construction they operate as satisfactorily on the 50-cycle circuit as rotaries do on 25 cycles. Furthermore, the direct-current voltage can be varied by shunt regulation independently of the a. c. voltage, a great advantage over the rotary converter system. The sub-station equipment also includes negative boosters and, of course, a high and a low-tension switchboard; there is no battery.

Perhaps the feature of most special interest on the system is the two electrically-operated swing bridges. Each bridge is operated by a motor-driven winch, whose power is transmitted to the bridge by means of a wire rope running over guide pulleys. In case of necessity, the motor can be thrown out of gear and the winch operated by hand. The bridges turn on rollers on a circular turntable, and are pulled around by the wire rope; they can be opened or closed completely in 40 seconds. The turntable is not in the middle of the bridge, but on the bank, the overhang being, of course, compensated.



THE CAMELON ELECTRICALLY-OPERATED SWING BRIDGE

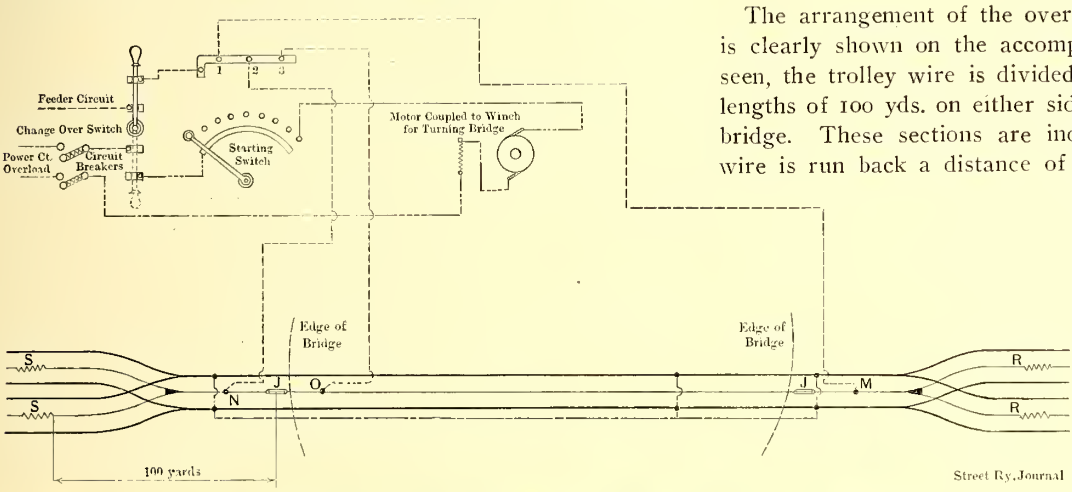
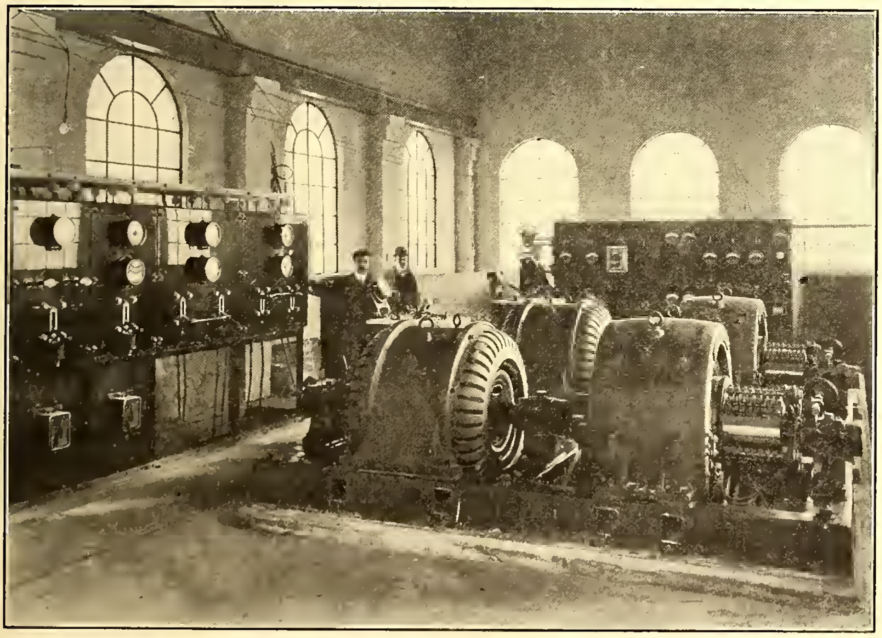


DIAGRAM OF CONNECTIONS AT SWING BRIDGE

The arrangement of the overhead equipment on the bridge is clearly shown on the accompanying diagram. As will be seen, the trolley wire is divided into three sections, viz., two lengths of 100 yds. on either side and the short length on the bridge. These sections are independently fed. The trolley wire is run back a distance of about 50 yds. from the bank as single wire, and then branches off into double line at the frogs.

Section insulators *S* and *R* are placed beyond the frogs 100 yds. on either side of the bridge, thus isolating the total length of line between *S* and *R*. The three lengths of line thus isolated from the rest of the system are fed at the points *M*, *N* and *O*, which are connected to a single-pole, double-throw switch in the motor house. The lower contact of this switch feeds the bridge-operating motor, while the switch center is connected to a positive power feeder. When it is desired to turn the bridge, the switch is thrown to the lower position, cutting off current from the overhead wire between section insulators *S* and *R*. Automatically-operated gates at either end of the bridge interlock with derailing switches some 20 yds. back, so that a car running by momentum with disabled brakes would be derailed. It will be seen that for a car to run into the canal is a physical impossibility.

As stated, Bruce Peebles & Company were the bulk contractors for this installation. Messrs. Harper Brothers were the consulting engineers, A. A. Campbell Swinton was electrical adviser, R. D. Munro was consulting engineer for the bridges and Messrs. Bramwell & Harris were engineers for the sub-station, which was supplied by the Scottish Central Electric Power Company.



INTERIOR OF SUB-STATION, WHERE CURRENT IS CONVERTED FOR USE ON THE FALKIRK & DISTRICT TRAMWAYS

The West Penn Railways Company has issued a neat, 1906, calendar, having for its center piece an excellent illustration of the company's power house and surroundings.

THE USE OF ALTERNATING CURRENT FOR HEAVY RAILWAY SERVICE

BY B. G. LAMME

In the electrical field, as in all others, there is a tendency to look at the immediate future development rather than to consider the more distant work. In consequence, it is general practice to adopt those systems and types of apparatus which meet the immediate requirements rather than those which will be most suitable at some later period. In consequence, any radical development or revolutionary departure from standard practice is met by the fact that it must conform, to a great extent, to conditions already existing. Only in rare cases is the old type rejected and something newer, but with greater possibilities, chosen. The first Niagara power plant is an example of the latter case. Here the engineers rejected the standard high frequencies and boldly chose 25 cycles. There is no doubt now as to the wisdom of the choice of low frequency, although there may be differences of opinion as to what is the best low frequency. The frequency of the Niagara plant had a very great influence in deciding the frequency for other large power plants, and its effect upon the development of the larger electric railway systems of the past eight or ten years is inestimable.

But in most cases, the lines of growth have been along some established system, and immediate necessities have generally carried such development beyond the legitimate limits of the system. In consequence, what was the most economical and least costly system at first, often becomes the costliest in the end. In attempting to correct such unavoidable mistakes, some very badly mixed systems have come to the front. Some of these have no function except to bridge over the gap between the old and the new. Also, in attempting to fit new methods to old ones, the problem is much complicated, just as it is harder to reconstruct an old machine for some new requirement, than it is to build a new machine throughout.

In the electric railway field the conditions are those indicated above, and any new system, no matter what an advance it may represent, must be, for a while at least, adaptable to present conditions.

Until a comparatively recent time, the entire electric traction work has been carried out by means of direct-current equipments on cars and locomotives. In the early days of electric traction the usual voltages on the car equipment was 450 to 500. This has increased very gradually until 600 to 650 is now in rather common use. However, this increase in voltage has been in no way comparable with the increase of service and extension of lines. In consequence, many years ago the direct-current transmission system for feeding the car equipments reached its limits, and it was necessary to adopt alternating currents for generation and transmission with transformation to direct current near the points where the power was to be utilized. As the traction systems were extended the number of transforming points was increased. In those cases where the service is comparatively frequent or fairly constant, such systems have operated in a very satisfactory and efficient manner. But where the load is very intermittent, such a system is not particularly efficient, for the transforming machinery may be operating for relatively long periods at practically no load, and for short periods at extremely heavy loads. Such a system, therefore, is well adapted for service in cities and immediate suburbs, but is at a considerable disadvantage on infrequent interurban service comparable with present steam conditions.

The present direct-current traction system has accomplished wonderful results, and it would be foolish for anyone to attempt to discredit it. However, there are limits to its application, and it would be equally foolish not to recognize them. The most important limit is the low direct-current voltage which has been used heretofore. The present method of overcoming this is by increasing the number of transforming stations and by vastly increasing the expense and complication of the system as a whole.

Future development in the heavy railway field appears either to be limited to the direct-current system with alternating-current transmission and sub-stations with machinery for transforming to direct current, or to a system supplying alternating current directly to the trolley wire and with equipments on the cars which can either use alternating current or which can transform to direct current.

If the present direct-current system with its transforming sub-stations is to be retained, then the future development must lie in the direction of increasing the direct-current voltage on the trolley and car system. This has been seriously suggested by Mr. Sprague and others from time to time, and undoubtedly many have wondered why it has not been carried out extensively in the past. It is no doubt generally assumed that this would have been done long ago unless there were some very serious reasons for not doing it. Such reasons are well known to those who are familiar with the difficulties which have been encountered with each comparatively small increase in voltage over our usual practice on the direct-current railway system. About fifteen years ago, 500 volts was usual, while at the present time 650 volts is rarely exceeded in regular service. It has been stated that the present 500 or 600-volt system is an arbitrary standard, and that there is no particular reason for retaining such a standard when occasion calls for higher voltage. However, as it has taken about fifteen years to obtain an increase of about 150 volts, while there has been good reason for years for going much higher, it is evident that something more than the mere adherence to a standard has prevented the use of higher d. c. voltages. Considering the willingness of manufacturers of electric machinery to make radical departures in other lines of apparatus, there is ground for belief that long ago they would have taken steps in the direction of increased direct-current voltage, if their experience had indicated the feasibility of doing so. In the alternating-current generation and transmission field enormous strides in increase in voltage have occurred from year to year; and alongside of such advances, the slight increase of approximately 150 volts in the d. c. railway field would seem absurd if there were not some fundamental reasons to account for it. As 1500-volt direct-current equipments have been talked about to a considerable extent in the past year or two, it would probably be of interest to many to know what difficulties could be expected with such a relatively large jump above our present practice. I will therefore mention some of the troubles which have been encountered in increasing from 500 to 650 volts, and this will furnish an indication as to what designers would expect if very much higher voltages are used. There have been isolated instances where high direct-current voltages have been used on car equipments, but in general it has been found that 600 to 700 volts represents the practical limit with present designs of apparatus. The difficulties in designing direct-current railway apparatus for higher voltage are not due to lack of ability to construct a railway motor which can be wound for 1500 volts, but largely in certain operating conditions found principally in railway service. The question of high-voltage control systems, high-voltage rotary converters, or motor generators, as well as high voltage on the motors themselves, must be considered.

In the direct-current railway motor, one of the most difficult conditions to be met is the tendency to occasional flashing. This is particularly found in the larger motors for heavy, high-speed service. On a small motor a flash may not be very destructive, but the larger the motor the more serious the difficulty becomes, as a flash may put the motor out of service.

In fact, in most cases it is only the efficiency of the control system and circuit-opening devices which saves the motors. It would undoubtedly be much more serious on higher voltage motors. On 500 volts it is seldom noted, but on 600 or 700 volts it appears to be much more frequent, even though such higher voltage motors are designed with a proportionately larger number of commutator bars, larger size of commutator, etc. This flashing is liable to occur when the circuit of the motor is opened momentarily and then closed again with the motor remaining connected across the circuit. If the magnetism of the motor has an opportunity to die down during the period that the current is off, then the first rush of current when the circuit is again closed will not build up the field as quickly as the armature. The result is an enormous rush of current until the armature counter e. m. f. rises, this current rush being accompanied by great field distortion, with consequent change of lead. This is itself is sufficient to account for many cases of flashing. In late designs of motors it is common practice to remove, as far as possible, all secondary or closed circuits around the field, in order that the field magnetism may build up more quickly. However, the solid yoke of the usual type of d. c. motor forms, to some extent, a secondary circuit retarding the rise in field magnetism, and also the armature coils immediately under the brushes form secondary circuits which may have enormous currents momentarily set up in them. These secondary circuits may cause momentary "spitting" or "blazing" at the brushes, and this latter action may also assist in starting a flash. Experience has shown that, with all possible damping effects removed from the field of the ordinary direct-current motor, there still exists a tendency to flash under certain conditions, particularly when the cars are operated on a trolley system which has considerable inductance, such as one with circuits largely of iron, conveying very heavy currents. In such a system, any sudden reduction in the current is liable to produce momentary voltage rises which may bring any motors connected across the system up to the flashing point, and this action has apparently been responsible for certain troubles in large systems. If, however, the normal voltage is raised to 1500 across the motors, experience tends to show that the above difficulties would practically prohibit their use if the present types of construction are retained.

There are certain ways in which this flashing tendency in high-voltage motors could be suppressed, but these involve very radical changes in the design. For example, they could be made entirely with laminated magnetic circuits with no closed secondary paths and no low resistance secondary circuits in the armature winding. The field would be provided with neutralizing or so-called "compensating" windings, which practically neutralize the magnetizing effect of the armature. In such a motor the field magnetism would rise almost instantly when the circuit was closed and the rush of current would be relatively small. Also, such current as did flow would produce practically no distorting effect on the field and but little change in lead. The armature coils, short circuited at the brushes, having no low resistance path, would have no heavy secondary current set up in them, and consequently there would be no particular tendency to undue sparking at the first current rush. Such a motor, when running at high speed, could be thrown directly across a high-voltage circuit without resistance in circuit, or could even be reversed without resistance, with no injurious effects as regards flashing. Such a motor would therefore form an ideal one for direct-current service. However, it would be relatively expensive to construct, and if wound for high voltage, would require a comparatively large number of turns on the armature and compensating windings. The field winding, however, could have comparatively few turns, as a stiff field is not required to prevent distortion.

The ideal type of direct-current motor which I have just described is, however, the one which has been developed for use with alternating current, and such a motor, with but relatively small expense, could be designed to make a rather good machine for operating directly on alternating-current circuits of low frequency. Therefore, in constructing the ideal motor for operating on high voltage direct current, we come directly to the construction which permits us to do away with direct current altogether.

Another feature of the high-voltage direct-current system which should be considered, is the question of the control system. I have no doubt whatever but that a 1500-volt control system will be more costly than one for 600 volts, and it will also be more liable to break-downs. While its construction is not impossible, yet I believe that a 1500-volt direct-current control will be much more troublesome to operate than a 600-volt control.

Passing next to the sub-stations or power house required with a high-voltage d. c. system, we find that it is necessary to use high voltage direct-current generators or rotary converters. A 1500-volt direct-current generator may represent a permissible design and it may not be unduly expensive. However, a high voltage rotary converter presents some problems which are not found to the same extent in the present low-voltage machines. A good non-hunting rotary converter possesses an inherent tendency to flash under certain conditions. It is found that on certain conditions a short circuit, momentary or otherwise, on the direct-current system, sufficient to open the circuit breaker at the rotary station, may cause the rotary converters to flash at the commutators. This effect appears to be dependent largely upon the alternating-current transmission system back of the rotaries. For instance, the d. c. short circuit may produce a momentary drop in voltage on the a. c. system supplying the rotary. The moment the d. c. circuit breaker opens and the short circuit is removed, the a. c. voltage at once tends to rise to normal value. The rotary, however, has had its counter e. m. f. lowered by the short circuit, and there is therefore a tendency to produce a momentary rush of current when the a. c. voltage rises. This rush of current momentarily changes the lead and may cause a flash at the commutator, which again produces a drop in the a. c. system, tending to reduce or stop the flashing. The result may be a series of flashes following each other quickly, and in some cases this is only stopped by cutting the machine out of circuit. It has been the practice in some cases to install automatic circuit breakers in the alternating side to get the machine out of circuit when this flashing occurs. However, the time required to synchronize is generally considered such an objection that the risk of flashing is considered the lesser evil and the a. c. breakers are omitted. Cases have been noted where several rotaries were connected to the same system, some operating without load, when a short circuit across one of the loaded rotaries has caused the empty ones to flash, indicating clearly that this effect comes through the alternating system.

Experience has shown that this possibility of flashing increases rapidly with increase in voltage. It usually is not troublesome in city and suburban plants where the a. c. transmission drops are comparatively small and where the loads are comparatively steady. The trouble increases in those cases where the line drop is liable to be rather large, and where the service is rather infrequent and the load fluctuates over a wide range. On account of this difficulty, it is generally not feasible to install rotary converter capacity in the substations corresponding only to the average load, but it must be more nearly comparable with the maximum load, in those cases where the service is very infrequent and the load fluctuates violently. With voltage of 1000 and 1500 on rotary converters, this flashing tendency would be enormously increased and might even prohibit the use of this class of machinery.

It has been noted that it seems to be, to a great extent, independent of the frequency, the number of commutator bars, size of commutator, etc., just as the flashing in a railway motor seems to be, to a certain extent, independent of the number of commutator bars and the size of commutator.

As to the construction of 1500-volt generators for constant potential service, while this may not be entirely impracticable, yet it is not a particularly easy problem to design them for railway service. It has been stated a number of times in the past four months that the construction of high voltage d. c. generators is not a difficult problem, as instanced by the 3000-voltage generators of the Thury constant-current system. However, it should be borne in mind that a 3000-volt constant-current machine represents a much easier condition as regards operation than a 1500-volt constant potential machine, such as would be required for railway service. In this country 6000-volt d. c. constant-current machines have been common practice for years, yet the builders of such machines are well aware of the fact that the constant-current feature is a very important condition in their construction and operation. A flash on a constant-current machine is not especially destructive, as the current does not rise to a dangerous point. On a constant-potential machine, however, the current may rise to an enormous value and its destructive effect may increase rapidly with increase in voltage, as the energy expended in the arc will be greater. Experience has shown that on 650-volt machines a flash is more vicious than on 500-volt machines. The tendency to flash will also undoubtedly increase with increase in voltage. Further, it is not fair to compare a railway machine with one terminal grounded with a high-voltage machine in which both terminals are insulated. In railway service, any momentary flash which reaches to any of the neighboring parts of the frame would short-circuit the machine unless the frame and parts are entirely insulated from the earth, while this would not be true in the case of a generator with insulated circuits. Taking all things into account, the design of a first-class 1500-volt d. c. railway generator with one terminal grounded presents such possibilities for trouble that those designers most able to construct such a machine are the ones who would raise the greatest objection to doing so.

The above is simply given to show that while it is easy to talk about the use of 1000 and 1500 volts on direct-current railway service, yet there are very serious difficulties which are encountered by the designers of such machinery. I have personally been in direct touch with the designs of direct-current railway motors, railway generators and rotary converters for many years, and am therefore familiar with many of the troubles which will have to be overcome with the high voltage direct-current system. But even if such difficulties are surmounted in 1000 or 1500-volt apparatus, we have simply extended the field of operation of the direct-current apparatus, but are yet far from the solution of the general railway problems. It would simply be a small step in advance of what we have now in the field, and the question of collection of current would still remain unsolved to a great extent. The present third-rail system, while it has operated admirably on 600 and 700 volts, would present serious objections on 1500 volts, and it is the opinion of many that if such voltage were to be used, then the overhead trolley system would also be used. A 1000 or 1500-volt overhead trolley system, while it is operative under many conditions, is far from being adequate for the general problems of traction which are to be met at some future time.

It has been recognized for a number of years by our leading engineers that the extension of electric traction to heavy railroad service is dependent to a great extent upon the use of much higher voltages than appear to be practicable with direct current. A number of methods of utilizing high voltage alternating current directly on the trolley have been more or less completely developed. One of these is the now well-known three-phase system with induction motors, variable speed being obtained by rheostatic control combined with cascade connection or with changing the number of poles on individual motors. This system operates successfully under certain conditions, but many engineers do not consider that it furnishes the proper solution of the general railway problem in this country. With this system, the two overhead trolley wires are at different potentials, and the problem of current collection, cross-overs, etc, becomes increasingly difficult as the voltage is raised. In consequence, it has not been advocated extensively for voltages higher than 3300. This is believed by many to be entirely too low a limit for the future railway field, and therefore this system will be, to a certain extent, in the same class as the direct-current system, from the fact that its voltage is limited.

Several systems have been developed for using single-phase alternating current for railway service. The great advantage of the single-phase is found, not in the characteristics of the motors themselves, as much as in the fact that with a single overhead wire there seems to be almost no limit to the voltage which can be used. Thirty-three hundred volts has proved to be extremely easy to handle; 6600 volts has also been tried out in a perfectly satisfactory manner; 11,000 volts has been adopted on at least one road, and I have no doubt whatever but that 22,000 volts will be given tests in commercial service within a reasonably short time; in fact, the Swedish Government tests are arranged to cover 18,000 volts on the trolley. It is therefore evident that the single-phase alternating current furnishes the solution of the transmission and trolley problems, for the complication and cost do not increase greatly with increase of voltage.

The success, however, of a single-phase trolley system depends entirely upon the apparatus for utilizing the current. A number of motor systems have been suggested, and some of them have been given a more or less complete trial. Among these may be mentioned the motor-generator type for supplying direct current to motors on the car. This is operative, but means much additional weight and cost, and is practically limited to locomotives. There is also the Arnold system, where a single-phase motor, either synchronous or induction, is operated in connection with pneumatic apparatus on the car. A third system, and the one which has been given the greatest development, is that in which some form of the series commutator type of motor is used. This latter forms what is now known as the single-phase alternating-current system.

It should be borne in mind that it is not any particular merit of the single-phase commutator type motor which constitutes the advantageous feature of the single-phase system, but rather the successful development of such a motor permits the retention of most of the advantages of the present direct-current system while many of its limitations are removed. The motor itself, in its characteristics, closely resembles the direct-current series railway motor, and this is considered one of the principal merits of the single-phase commutator type motor. Having these characteristics, the motor is susceptible of economical speed control, just as in the case of the direct-current motor, but this feature can at once be taken advantage of in an alternating-current system, due to the fact that voltage variation can be simply and economically obtained as soon as we are dealing with alternating currents. The development of such a motor, therefore, at once permits us to use any desired voltage on the trolley system, and this can be transformed to any suitable lower voltage for the motor system, and such voltage delivered to the motor system can be varied economically over any desired range. Herein lies the true merit of the single-phase system and not in any inherent superiority of the motor itself. In fact, the motor itself is superior to the direct-current motor in only a limited number of features, while it is inferior in a number of others. The alternating current commutator type motor is necessarily built along lines which would make a very superior direct-current type of machine, and therefore in comparing the alternating-current motor with the direct-current motor, it is only fair to compare it with what could be obtained from the same material and construction properly applied in a direct-current machine. Under such condition the direct-current motor will undoubtedly show extremely good characteristics. In fact, certain types of single-phase alternating-current motors now in the market are in reality very fine direct-current machines, and will operate on direct current in many ways more perfectly than any purely direct-current motor now on the market.

As stated before, a direct-current motor designed for very high voltages to operate without flashing would probably approach very closely the design of a single-phase alternating-current motor. Therefore it has been a question with the manufacturers, whether, instead of going to these refinements to obtain a limited increase in voltage on direct current, with the accompanying high-voltage control, high-voltage d. c. generating plants, etc., it would not be advisable at once to wind the motor for alternating current, and thus open the way for the use of much higher voltages and at the same time obtain a low-voltage control system which is of the most efficient known type, namely, variable e. m. f. from transformers.

A single-phase system with commutator type motors, therefore, possesses the following features of prime importance in heavy railway work, namely, very high voltage with relatively small currents can be used on the trolley circuit; low voltage on the control system and motors; a method of control which varies the voltage in an efficient manner; a type of motor with the speed characteristics of the direct-current motor and therefore susceptible of speed control over the entire range from zero to maximum when used in connection with the above-mentioned voltage control. Finally, the motors and control are connected to a low voltage secondary circuit which can be insulated from the main circuit, if so desired. Another feature of great importance is that the motors can be so arranged that they can be operated in a very satisfactory manner on direct current as well as alternating. This latter feature may not be of great importance, except in the immediate future, but at first it is probable that quite a number of the a. c. railway systems will have to operate in connection with existing d. c. plants. In this use of the motors on both alternating and direct current, this system is undoubtedly much superior to the three-phase system, even when the motors of the latter are equipped with commutators.

For heavy railway service equivalent to present steam practice, this system commends itself in many ways. Trolley voltages of 6600 or higher now appear to be necessary for such service. Speed control over any desired range, especially for freight service, is of extreme importance and can readily be obtained with this system. With voltage control and commutator type motors the power consumption at the motors is moreover practically in proportion to the load, and, when running with a given load, at the lowest speeds the power consumption is a minimum. In this feature the single-phase railway equipment resembles the present steam equipments. A further feature of great value from the operating standpoint is that a sudden overload or momentary short circuit does not mean a shut-down of the system for any considerable period of time. As the trolley system is fed from the lowering transformer simply, without interposition of moving machinery, a short circuit will have the effect of lowering the voltage temporarily, and as soon as the short circuit is removed the voltage can rise to normal and the system is at once operative. In the present a. c.-d. c. system, however, a severe short circuit is liable to shut down the system for quite an appreciable period until the sub-station machinery can again be brought into service. Furthermore, with the a. c.-d. c. system the momentary load which can be taken is dependent upon the rotating sub-station apparatus, to a great extent, while with stationary transformers alone an enormous overload can be carried for a short time without deleterious effects. The system is therefore a very suitable one for infrequent and violently fluctuating loads. The efficiency of the lowering transformer is quite high over a very wide range, which is not equally true with the rotating machinery, such as is required for transforming from alternating to direct current.

The number of sub-stations and their distribution can be made to conform to the load conditions to any desired extent. For instance, if there is any point where there will be a particularly heavy pull on the system, such as a difficult grade, then a transformer station can be placed at this point.

Another feature possessed by this system is the ability to increase or extend the service with but a relatively small increase in cost. For example, if the service on the road should be doubled or tripled after it is installed, then the number of transforming stations could be doubled or tripled, if desired, these stations being placed between the older stations. In this way the transmission and the trolley systems could remain practically unaffected. Also, an extension of the system at either end could be accomplished in many cases by simply extending the existing lines, without the addition of feeders along the whole system. In other words, the system could be extended very greatly with a cost in the transmission and trolley systems practically in proportion to the extension.

On account of the comparative newness of the system, the question has been raised from time to time whether single-phase alternating motors of suitable size and capacity can be built for heavy railway service. But as such motors have been built and given severe tests, and are being built in comparatively large quantities, and as those manufacturers with experience in the design of such machinery state positively that they can build such motors, there should be no further question on this point. The question seems to be turning now to the comparative economy of the single-phase system and the direct-current system with transforming sub-stations. This is a question upon which it is rather difficult to give any decided answer, as the results would depend on each individual case. The distribution of the losses are so different in the two systems that it is hard to make any comparison unless a rather complete analysis is made. The efficiency of the single-phase alternating-current motor is necessarily somewhat lower than that of a corresponding d. c. motor; also, there is an additional loss in the transforming apparatus on the car. Furthermore, an additional amount of power is required to operate the a. c. equipment, due to greater weight. The single-phase motors are necessarily somewhat heavier than d. c. motors of same rating, due to a considerable extent to the fact that in the alternating-current motor the steel supporting frame is idle magnetically and therefore constitutes dead weight, while in a direct-current machine the supporting frame or yoke is active magnetically, and therefore constitutes useful material. This, in itself, may represent a difference of 15 per cent or 20 per cent in weight between the two types of apparatus. Also, the lowering transformer on the car or locomotive represents an additional weight over the d. c. equipment. The rheostat required on the d. c. system is, however, omitted on a straight alternating-current equipment, although it will be required when the equipment is used for both alternating and direct current. In other features, however, the alternating and direct-current equipments are not so very different in weight. Taking all these facts into consideration, the alternating-current equipment will probably weigh from 5 per cent to 10 per cent more than the direct-current equipment, and therefore additional power is absorbed in the operation of the car, due simply to this weight. Therefore, as regards power consumption at the car itself, the alternating-current equipment when running at the same speed as a direct current, requires somewhat more power.

If the system is such, however, that there is very frequent starting, then the alternating-current equipment, using voltage control only, will be more economical during acceleration than will the direct current with its rheostatic and series-parallel combinations. In such cases the difference in economy at full speed may be partly or wholly offset by the better enonomy of the alternating equipment during acceleration. However, this does not apply to any extent to other service where the steps are relatively infrequent.

Passing to the trolley part of the system, it may be noted that with the very high voltage which can be used with the alternating system the trolley losses can be made very low compared with average d. c. conditions. For long lines, the gain in this part may much more than offset the loss in the equipments, and therefore the two systems may be on a par as regards economy beyond the transformer stations.

In the transforming sub-stations the d. c. system requires either rotary converters or motor generators for transforming from alternating to direct current. In addition, reducing transformers are required for changing from the high-voltage feeder system to the low voltage required by the transforming apparatus. The efficiency of a rotary converter when fairly well loaded is very good, but if the service is very intermittent the average efficiency of the rotary converters may be but little over 90 per cent, if that high. With motor-generators, the efficiency will be from 2 per cent to 5 per cent lower than with rotary converters. The efficiency of the reducing transformers in these sub-stations is comparatively high. If the single-phase trolley system is fed from transformer stations, then the transformer losses will be present, and it is only the difference in loss due to the rotary converters or motor generators which should be considered. If, however, the trolley voltage should be so high that it can be supplied directly from the generator, without transformers, then there would also be a gain in efficiency of the single-phase system due to the elimination of the transformers themselves. Even with transformers in both cases, the single-phase system could use one or more large transformers in place of a larger number of smaller units generally used with rotary converters or motor generators.

It may be suggested that with motor generators the motors could be wound for very high voltage, thus avoiding the use of step-down transformers. This can be done in some cases, but it should be borne in mind that the efficiency of a very high-voltage motor is in general 1 per cent to 2 per cent lower than a correspondingly low-voltage motor, and thus the gain in efficiency due to omission of transformers will hardly bear consideration.

Going back to the power house, we find that in most cases the single-phase system requires somewhat less total output that the a. c.-d. c. system with rotary converters or motor generators. This means, therefore, that the efficiency of the single-phase system as a whole is somewhat better than that of the a. c.-d. c. system; about 5 per cent to 10 per cent in most cases. It is this gain in efficiency in the combined system which is important, and not the gain or loss in any particular piece of apparatus. If the single-phase system shows a lower power consumption, with the same service, than the a. c.-d. c., then it is absurd to criticise the lower efficiency of the car equipments themselves.

Considering next the total cost of such a system, we are again confronted by the fact that different results will be obtained in each individual case, but considering the problem in a general way only, the results indicated below have been obtained. The power house for either system will cost very nearly the same. The power consumption in the single-phase system will average slightly less than that of the a. c.-d. c. system, but part of the apparatus in the power house will be more costly if the ideal single-phase system is installed. The generators themselves for supplying straight single-phase current should be somewhat more expensive than polyphase machines used with the rotary converter system. This is due partly to the fact that single-phase machines as a rule are larger and heavier than polyphase machines for the same output, and also to the fact that the regulation characteristics of the two systems may be quite different. In the a. c.-d. c. system the regulation of the generator itself may be comparatively poor and the rotary converters may be compounded to correct for this. In the single-phase generator for railway work, however, all compounding is done at the generator itself, and therefore the machine must have fairly good characteristics in itself. There are also other features in the station which may modify the relative costs somewhat, so that as a rule the power houses for the two systems may be considered as having relatively the same costs. If the power house should represent a comparatively high per cent of the total cost of the system, then this parity in this one large item may mask to some extent the difference in per cent in the remaining items. For instance, if in the other items the single-phase system should cost 20 per cent less than the a. c.-d. c., and the power house equipment should represent 50 per cent of the total cost, then the single-phase system would have an apparent advantage of much less than 20 per cent of the total cost, while with the power house equipment representing a smaller per cent of the total cost, the single-phase system shows somewhat better. The actual figures should be looked at and not the per cents.

Beyond the power house the high-voltage transmission line, if one is used, may represent practically the same cost in either system. In the sub-stations, however, if such are used, the single-phase system may have one or more transformers of relatively large capacity compared with a larger number of smaller transformers with the a. c.-d. c. system. The cost of transformers with the single-phase system should therefore be less. The cost of the rotary converters or motor generators is entirely wiped out with the single-phase system. Therefore this system represents a very considerable gain in cost in the sub-stations. The cost of the buildings themselves can also be reduced as their size can be reduced.

Coming to the trolley system, the high-voltage trolley construction itself may represent a higher cost than the usual direct-current constructions, neglecting feeders. However, when the d. c. feeders are included, the total cost of the direct current part of the transmission system is found to be much higher than that of the high voltage alternating trolley system without feeders. When the car equipments are reached, however, we find the conditions reversed. On account of the construction of the motors themselves, with their thoroughly laminated fields and supporting frames, which represent extra material, the cost is very materially increased over that of the present types of direct-current equipment. Also, the cost of the lowering transformers on the car must be added. If the equipment is to be used for both a. c.-d. c., there will be some extra cost due to added switching and controlling apparatus. Therefore, taking everything into account, the cost of the a. c. equipments is very considerably higher than for corresponding d. c. equipments. However, in general it has been found that this increased first cost of the car equipment does not merely neutralize the gain in other parts of the system, for in the ordinary a. c.-d. c. system the cost of the electric equipments on the cars represents but a small per cent of the total cost of the system, and therefore a large per cent increase in this smaller item will not be equal to a relatively large decrease in cost of some of the larger items. As a rule, therefore, it has been found that the total first cost of the single-phase system is considerably lower than that of the standard a. c.-d. c. system, the difference depending upon individual conditions. Not considering the power house, in some instances this difference may amount to as much as 30 per cent, while in others it may be as little as 10 per cent.

The above considerations of efficiency and cost have been based on usual conditions of operation as handled by the present a. c.-d. c. system, but in service corresponding to heavy steam conditions there are other conditions entering which affect the comparison of the two systems. For example, the question of economy of speed control should be considered when it comes to freight service, or in those cases where it is necessary to run for considerable periods at other than the normal speeds. With the present d. c. system, between half and full speed, that is, between series and parallel, there is no economical running point, and rheostatic control must be used with corresponding reduction in efficiency. However, with the single-phase system, the number of speeds which can be obtained are directly proportional to the number of voltages which can be supplied from the step-down transformer. As a rule, the number of steps are rather large, and a corresponding number of efficient speeds are obtainable. Therefore, the single-phase system, for such condition of service, is much more efficient than the d. c. system, not going beyond the car equipments themselves. Taking the whole system into account, in such cases, the total efficiency should amount to many per cent better than in the a. c.-d. c. system. Therefore, in any condition where the d. c. system requires any considerable use of the rheostat for regulating the speed, the single-phase system has the advantage in economy as far as the equipment itself is concerned. But under conditions where the d. c. equipment does not require a rheostat the advantage is in its favor. Such conditions, however, would be the exception rather than the rule, in service corresponding to that of the present steam roads.

AN OPEN LETTER TO MR. WESTINGHOUSE

BY MR. SPRAGUE

So your reference to me in your recent letter to "The Railroad Gazette" was "not intended to do Mr. Sprague an injustice"; that is probably the reason why it was written and spread broadcast. Those who have the patience to follow this subject will quite likely reserve to themselves some right of judgment, and will be able to form a correct opinion as to your real motives.

Contrary to your suggestion, I did not forget to mention anything of pertinence or proper public interest, in so far as it concerns my comments on the adoption under existing conditions of a. c. locomotive operation on the New Haven terminal division, but in order to confine myself to that particular case, and to avoid being wrongly, even with apparent reason, put in a position of antagonism to any rational application or development of the a. c. system, I did omit many things which might with entire truth have been said concerning the special difficulties naturally being experienced in that development, and many other things which my official relations would not permit me to say.

But in spite of my moderation you have made references to my contracts which are incorrect as to fact and foolishly untrue in inference. Permit me to correct you as to both, for if the public is at all interested in any personal discussion between you and myself, it might as well know the exact state of affairs.

I have at present a contract with the Sprague Electric Company, an extension of one I have had for a number of years, during which time it was an active competitor of the principal electric companies. By this contract it became the owner of my patents, and it has naturally and very properly restricted me from engaging in rival manufacturing, or advising those who are so engaged.

Further, in part liquidation of a royalty agreement covering the use of the "multiple-unit" system, I agreed to accept an annual payment during the term of the patents covering that system, if living, and required a guarantee that my name should always be used as designating it, not only by the Sprague Company, but by any successor or licensee of it. But whether those patents be used or not, this payment is not affected by a penny's worth, nor by any other act of mine. The contract makes no mention of any railroad corporation, nor is any such intended, and it is a rare order of imagination which would convert the railway and power transmission companies of the country, the customers of the great electrical manufacturers, into corporations which may be classed as unfriendly to them.

This contract, under present conditions, confers upon the officials of the General Electric Company no authority whatsoever, so far as I am concerned, and no man knows better than yourself that I would brook no interference by individual or corporation with my professional opinion or action when engaged as a consulting engineer.

I have in addition a contract with the General Electric Company, a brief one, whose sole provision is a guarantee that the Sprague Company shall fulfill its obligations to me, the chief of which in my opinion is the use of my name in connection with all multiple-unit apparatus, no matter what the details.

Such is the legal status of my contracts, and it is in no sense altered because the General Electric Company is now the owner of the stock of the Sprague Company, or because it may become its successor in the event of that company's assignment or liquidation. I cannot, therefore, recognize your privilege to interpret these contracts in a light contrary to their spirit, or in any manner other than is mutually acceptable to the present parties to them, even though it may serve your personal purposes to do so.

But assuming, despite your forgetfulness and inaccuracy, that in place of the Sprague Company the General Electric Company becomes the principal, by whatsoever official action of the Sprague Company, with what poor grace comes your attack on me when by reason of that very fact, because of agreements between your own and the General Electric Company in force for the past ten years, you would become, under like terms, the direct beneficiary of every patent advantage thereby derived, and the indirect beneficiary by my abstention from manufacture.

You have said that I have a "particular personal interest" in my "own form of control," and thereby attempt to differentiate the apparatus built by your company. You are, of course, aware that I have here no monetary interest whatever in its use, and it would have been nearer the truth had you stated I had a pardonable personal pride in a system absolutely of my creation which has revolutionized electric train operation, a system which you are widely using, and in whose adoption to your special requirements you have the active aid of my former confidential assistants. Were you as careful to recognize the rights and equities of others as you are tenacious in upholding of your own, you would not let an hour pass before directing in this instance the proper recognition of my name, instead of waiting until the slow and tedious process of law may compel such acknowledgment.

The true inwardness—and the littleness—of your reference to me lies in its suggestion that I am not independent enough to pass upon the merits of a proposal submitted to me, or that the New York Central Commission has not accorded your company fair treatment. So far as my friends are concerned, I need no defense, for they know that my engineering instincts rise supreme above any personal interest when acting in an advisory capacity, and the New York Central can best answer whether I have maintained the standard which it exacts from all who serve its interests.

A single fact, and not the only one with which you were conversant, should have made you more cautious in your reference to me, for you well knew when you penned your letter that, despite your assertion that natural inclination would lead the New York Central Railroad to award contracts, if it could do so on a sufficiently favorable basis, to a manufacturing company whose works are upon its lines, you had been awarded one of the most important contracts in its equipment, that for 27,000 kw of rotary converters, with my full accord and approval.

It is to be regretted that in reflecting upon that Commission you seem to have forgotten its composition. Permit me to remind you that, as one of its members, it has been my pleasure for a considerable portion of the time to be associated with the then vice-president of an organization absolutely controlled by Westinghouse interests, but although we often for a time may have disagreed, in all the deliberations which affected the New York Central interests I have done myself the honor to give him, as I believe he gave me, the credit of recognizing in the highest degree the judicial character of our positions.

As you well know, the decision affecting the present equipment of the New York Central Railroad has nothing whatever to do with future extensions. It was dictated in part by local conditions which are just as distinctive and determinate to-day as when the equipment was decided upon. These reasons have been time and again set forth, and both collectively and individually the Commission has made it clear that its decision was not necessarily to be taken as a precedent, that there was no antagonism to any particular system, and that when the problem of such extensions should come up every possible advantage would be taken of electric developments of any nature and from any source. Hence the attempt to get the New York Central Railroad to abandon matured plans, to terminate its contracts, and to adopt your proposal for a change of its equipment, in so far as such proposal could be influenced by cost comparisons extending to the balance of its system, is without the slightest basis of reason, nor was it helped by estimates which, being wide of the facts, are utterly worthless.

I find myself, with others, wondering what has caused your somewhat rabid general denunciation. Is it a tardy realization of the importance of my letter, now ten weeks old, or appreciation of its truth, or changes in some of the original intentions of the New Haven Company, or difficulties which have manifested themselves on existing a. c. equipments, or in the carrying out of the New Haven projects? Perhaps it was the loss of the Camden & Atlantic City line to a direct-current equipment, or an important single-phase road to a rival, but these are the fortune of war, and a saving sense of humor will prevent an attack of melancholia. Perchance, some coolness in the reception of your ex-parte statements, privately circulated a month ago, and now in part made public, has made necessary an attempt to bolster them up, but in any event your position will hardly be strengthened by over zeal or misdirection of statement, even when illustrated by exceptional cases of electrolysis, easily avoided and having little bearing upon the general railroad problem.

You take personal offense because I have pointed out some of the difficulties which will naturally characterize the progress of the a. c. development, and the special ones which it challenges in a particular case, and have essayed to make it appear that my opinions were dictated by a spirit of special friendliness to another company. Permit me to inform you that I have on frequent occasions stated that whatever excuse there may have been for the enthusiasm of your engineers—and there was much—there would have been little for those of the General Electric Company for making a similar proposal under like conditions, because they, probably even better than your own men, knew the limiting conditions.

Had the New Haven road restricted its equipment, as seemed to many for the time wise, and for the special reasons adopted in a limited territory direct-current operation, it would not, contrary to your statement, have necessarily meant apparatus of General Electric manufacture, for as I have already pointed out, an equal right of construction lies with your own company. Nor, save on the one question of locomotive pooling, was there any need for restriction in the details of apparatus.

I stood in that matter as I hope I may always stand, for what I believe to be the best interests of the public and the electric railroad development, irrespective of any personal interests or business affiliations; and had my criticisms lacked the essential elements of truth and common sense, one would have supposed that in the supreme confidence which you profess you would have been content to have awaited the issue, and to have witnessed my discomfiture and the acknowledgment of the error of my ways and opinions, which I think in that event I am broadminded enough to have made. But I have ample reason to believe that, distasteful as my criticisms may have been to some, when measured by public convenience and safety, results of importance have already been accomplished, and even more are sure to follow.

The charge that the General Electric Company and myself are engaged in a conspiracy to fasten upon the railway world the direct-current system as opposed to the alternating-current or any other particular system unduly enhances my importance, and is an amusing product of imagination, or the result of hysteria.

I must remind you that I was probably the first engineer in this country to recommend, in an official report some fifteen years ago, the general adoption of alternating current for the transmission of power over long distances, and I have not changed my attitude since. I have also to call your attention to the fact that not only have I steadily advocated higher potentials, but several years ago I publicly expressed the desirability of the development of single-phase motors for use on electric railways. And in order that you may not, unchallenged, appropriate to yourself all initiation in this art, I must not forget to mention the late lamented Charles Van Depoele, whose name you may be familiar with, who, in addition to much other admirable pioneer work, some sixteen years ago advocated and patented a method of using single-phase currents on electric railways.

In instructive contrast to your assumption as to my affinities, it is a curious coincidence that at the very time of the issue of your letter I should have committed myself to a belief in the possibilities, and stated my readiness to assume the responsibility under some circumstances, of a d. c. operation at a potential three times as high as your engineers have fixed in making comparisons between the two systems, a potential which, it is proper to point out, has not yet received the endorsement of your own or the General Electric Company. I therefore can hardly be accused of speaking for either in thus taking this public stand, but rather as the representative, as I have always tried to be, of consistent advance by all lines in an art to which I have devoted my life.

You object to healthy criticism, but in your self-constituted position as universal engineering advisor and mentor, has the New York Central, or its Commission or the General Electric Company been free from such? On the contrary, you have been unsparing in predictions of disaster. The use of the particular turbines selected was to be followed by a frightful accident, and their replacement by your own, and the locomotives were destined to absolute failure; but the former seem to function satisfactorily, and the latter has a record as yet unequalled by any like piece of apparatus. True, you made no predictions of failure concerning that admirable part of the equipment which your company is to supply, although now so energetic in condemning its use elsewhere.

Your attack on me is misjudged, and is unworthy of your own dignity, for even if your personal qualities do not appeal to the softer side of my nature, and your assumptions do not always carry conviction, I still recognize in you many elements of greatness. It will therefore fail in its purpose, for it will not cost me a single friendship, and will not impair the confidence of my associates, nor do I believe it will adversely impress any fair-minded man though he be a stranger to me. I will go further—it will not affect my appreciation of the many splendid products, or affect my final judgment concerning any developments or proposals of the Westinghouse Company, which will live on even after your dominant personality in its affairs disappears.

Permit me in conclusion to remind you that my work and inventions have been among the stepping-stones to your great fortune, and while others, and not I, have reaped the larger material rewards of that pioneer work, I have at least succeeded in impressing my name upon the electric railway development in such indelible fashion that you cannot erase it. It has never stood for doubt, or cowardice, or fear of consequences, but always for advancement—in which in many important particulars you have followed, not led me.

My engineering convictions and conclusions are my own. They are dictated by no man or corporation. I am not the advocate of the use of any particular system to the exclusion of any other, but rather of higher potentials and the greatest measure of development by whatever means—for such system as in any particular case shall, when measured by all conditions of equipment and operation, best fulfill the requirements of that case.

That attitude is one which I shall consistently maintain, unchanged by clamor, pressure or disapproval, and so long as I am given life and strength, and retain the confidence of my associates, I shall help carry to success the enterprise which you have so freely criticised, and thus aid in planting another milestone to mark the advance of electrical accomplishment.

The following correspondence is appended by Mr. Sprague to his open letter to Mr. Westinghouse:

New York Central & Hudson River Railroad Company,
Grand Central Station
New York, Jan. 2, 1906.

Mr. Frank J. Sprague, 20 Broad Street, New York City.

Dear Mr. Sprague:—Referring to recent discussions in the public press, in which your name has appeared in connection with decisions of our Electric Traction Commission:

It affords me pleasure to state that the relation that you hold to other interests has always been free and open to me, and that your attitude toward the different bidding companies has been entirely unbiased and impartial, as evidenced by your advocacy of what you have considered to be the apparatus best suited to our needs, no matter by whom manufactured.

Yours sincerely,
W. J. Wilgus, Vice-President.

New York City, Dec. 29, 1905.

General and Sprague Electric Companies.

Gentlemen:—I call your attention to a letter signed by George Westinghouse, which appears in the "Railroad Gazette" of Dec. 22, and is repeated in other journals, in which, referring to my critical attitude concerning the adoption of alternating-current locomotives by the New Haven Railroad under existing conditions, he makes the following statement:

"Mr. Sprague forgot to inform the public, probably as he would have done had he had more time, that he is receiving a very large retainer under a contract of years' duration, whereby, though he may become consulting engineer for a railroad, yet he cannot do so if, in the opinion of the officials of the General Electric Company, such work or obligation may be in conflict with the interests of that company."

My only contract with the General Electric Company is a brief one, simply guaranteeing the fulfillment of the Sprague's Company's obligations to me, and although my contract with the latter company—which bought my patents—is intended to prohibit my engaging in rival manufacture or consultation for a manufacturer engaged in a like business, I am not aware that, even if the General Electric Company has bought the Sprague Company, there is any reasonable ground for assuming that the officials of either company have the remotest right of interference with my legitimate work, for it is only proper for me to say that any such attitude would be distinctly opposed to my views.

I beg, therefore, to inquire if there is in your understanding of my contracts any justification for Mr. Westinghouse's inference, or anything which would in your opinion entitle you to such prohibition, or which would interfere in the remotest degree with such action on my part as may be dictated by the very highest interests of my clients.

An early reply will be appreciated.

Very truly yours,
Frank J. Sprague.

General Electric Company
New York Office, 44 Broad Street.
Jan. 2, 1906.

Mr. Frank J. Sprague, 20 Broad Street, New York.

Dear Sir:—Referring to your letter of Dec. 29, 1905, our policy is, as you know, to refrain from entering into a controversy in the newspapers over any particular system advocated either by our companies or by their competitors.

It is solely on account of your personal relations to the various traction interests of the country that we are writing this letter.

There is no reason, so far as the General Electric and Sprague Companies are concerned, why you should not act as consulting engineer for any steam railroad or for any power company, nor any reason why you should not give such companies for whom you act as consulting engineer such advice as seems to you proper, regardless of whose apparatus is to be used.

The General Electric Company and the Sprague Company are doing their utmost to develop the electrical art along all lines instead of wasting time in personal recriminations. These companies give the best engineering advice of which they are capable on the various propositions, which are from time to time submitted to them, and if, in any proposals which they may make for the equipment of steam roads, your judgment prompts you to decide in favor of a system which is recommended by their competitors, we feel sure that you will not hesitate for one moment to recommend such system.

The General Electric Company is in the business of manufacturing electrical apparatus, and is prepared to furnish alternating or direct-current systems as may be suitable. It has perfected what it believes to be the best alternating current railway system in the world, and wherever the circumstances make the use of such a system desirable, it recommends its adoption in preference to the direct system. The company does not, however, endeavor to force either system on the customer irrespective of the best engineering practice with reference to the special conditions under which the system is to be operated.

Very truly yours,
General Electric Company,
E. W. Rice, Jr., Third Vice-President.
Sprague Electric Company,
Allan Bakewell, President.

ELECTRICAL EQUIPMENT FOR THE SIMPLON TUNNEL

In the issue of Dec. 9 it was stated that Ganz & Company had received a contract for the electrical equipment of the Simplon line, between Switzerland and Italy. Later information from Ganz & Company, as well as by Brown, Boveri & Company, indicates that this statement is not strictly correct. As a matter of fact, the electrification of this line has been entrusted by the Swiss Government to the Swiss firm of Brown, Boveri & Company, who are already well known for their three-phase traction work in connection with other Swiss railways. On the other hand, inasmuch as the Simplon line reaches into Italy, and will eventually be operated jointly by the Swiss State Railways, and by the Italian Government, the latter has arranged with Ganz & Company for the use of some of the three-phase locomotives now employed on the well-known Valtellina line for the Simplon tunnel, and has placed these locomotives at the disposal of the Swiss Government, so that the tunnel may be opened for public traffic in June, 1906. Brown, Boveri & Company are now building two further three-phase 1000-hp electric locomotives, which will also be used to handle the traffic through the Simplon tunnel.

COMPLETION OF IMPORTANT LINK CONNECTING THE INTERURBAN LINES OF OHIO, INDIANA AND MICHIGAN

One of the most interesting events in the history of electric railway building in the Central West took place at Findlay, Ohio, last Saturday, when a golden spike, presented by the Street Railway Journal, was driven by President A. E. Akins, of the Western Ohio Railway, in the last rail of that company's Findlay-Lima extension.

The importance of this connecting link is graphically shown in the accompanying map, in which the link is indicated by a heavy dotted line. It will be seen that with this connection it is now possible to travel continuously on electric lines throughout Northern Pennsylvania, Ohio, Michigan and Indiana. The building of electric lines in these States has been somewhat peculiar, from the fact that the lines have been in groups, leaving a strip extending clear across the northern portion of Pennsylvania, Ohio and Indiana which had never been crossed. For some time it has been possible to travel from Northern Pennsylvania points across Northern Ohio into Central Michigan, or from points in Eastern Ohio to points in Western and Northern Indiana, but the lines in Michigan and Northern Ohio have had no physical connection with those of Central and Southern Ohio and Indiana. It is also interesting to note that geographically this 32 miles extension is almost exactly in the center of the traction development of the Central West. The completion of this line renders possible a journey from Titusville, Pa., to Crawfordsville, Ind., a distance of about 615 miles, by electric lines. The importance of the event is still more obvious when it is stated that the connected properties include forty-eight roads in Ohio, with a mileage of 2261; eight systems in Michigan, with

MAP SHOWING THE PRINCIPAL INTERURBAN ELECTRIC RAILWAY SYSTEMS IN OHIO, INDIANA, MICHIGAN AND WESTERN PENNSYLVANIA. THE CONNECTING LINK, WHICH WAS COMPLETED ON DEC. 30, IS INDICATED BY THE HEAVY DOTTED LINE BETWEEN FINDLAY AND LIMA. THE LIGHT DOTTED LINES SHOW PROPOSED LINES OR THOSE UNDER CONSTRUCTION a mileage of 482; three roads in Pennsylvania, with a mileage of 75, and eleven roads in Indiana, with a mileage of 888. This makes a total of seventy individual properties, with a mileage of 3706, not taking into account over a thousand miles of city lines. If stretched out in a continuous line this would extend from New York to San Francisco, with 300 miles for double tracking, or it would extend from New York to London.

To the electric railways of this district this event is almost as important as was the completion of the Union Pacific Railroad to the steam lines forty years ago, and the management of the Western Ohio Railway Company proposed that it be appropriately celebrated with a ceremony similar to that which attended the completion of the first trans-continental steam road.

The ceremony was accomplished after many annoying vicissitudes. General Manager F. D. Carpenter, of the Western Ohio, invited traction men from all over the three States, and special cars were arranged for from Indianapolis, Fort Wayne, Dayton and Cleveland. The plan was to run the cars through to Findlay, where the ceremony was to take place, and to drive the spike between the cars from these distant points, and then for the entire party to run over the new line to Lima for a banquet. On the morning of Dec. 31, the day selected for the ceremony, it was found impossible to carry out this plan, owing to the fact that a short piece of city track in Lima, the property of the Lima Electric Railway & Light Company, had just been relaid on concrete, and it was considered by the management of that company inadvisable to allow cars to operate over it. The Fort Wayne and Indianapolis aggregations were, therefore, turned back by telephone, while the two carloads of guests from Dayton, who had already arrived in Lima, were conveyed in carriages around the quarter mile of embargoed track to two special cars from Findlay, which were sent over after it was found that the other cars could not get through. The ceremony was to have taken place at Findlay at 2 p. m., but the first car from the southern contingent did not arrive until 5 p. m. The second car from the south was still further delayed, and did not arrive until after the ceremony and an impromptu banquet provided at Findlay were over, and the Cleveland contingent had started for home. The second Dayton delegation came into the hotel at Findlay singing the appropriate song, "Hail, Hail, All the Gang is Here Now." Hungry and tired they carried out a celebration of their own which lasted until late in the evening.

The driving of the golden spike was effected by the aid of the moonlight. President Aikins made a few appropriate remarks, and read the inscription on the spike as follows: "Last spike in the link connecting Pennsylvania, Ohio, Michigan and Indiana electric railways. Driven at Findlay, Ohio, Dec. 30, 1905. Western Ohio Railway. Presented by the Street Railway Journal." Then, with a few taps, the spike was driven home. Afterwards it was extracted and replaced by another of less brilliant color.

During the supper which followed, addresses were made by E. C. Spring, president Ohio Interurban Railway Association; A. E. Aikins, president Western Ohio Railway; F. T. Pomeroy, president Cleveland & Southwestern Railway; H. W. Blake, editor Street Railway Journal; the Mayors of Findlay and Lima, and several other gentlemen.

The Cleveland contingent included F. T. Pomeroy, president; E. F. Sneider, secretary; C. N. Wilcoxson, general superintendent; J. A. Nestor, superintendent; J. O. Wilson, passenger agent; L. M. Coe, M. A. Sprague, W. D. Thompson, directors of the Cleveland & Southwestern; W. M. Bicknell, president Lake Shore Electric Railway; Will Christy, vice-president Northern Ohio Traction & Light Company; A. E. Aikins, president Western Ohio Railway; C. R. Morley, president Stark Electric Railway; J. F. Collins, Toledo Railways & Light Company; W. E. Davis, Cleveland Construction Company; W. H. Abbott, Roberts & Abbott; H. W. Blake and George S. Davis, Street Railway Journal. The car left Cleveland at 6:10 a. m., and made a fast run of 4 hours 10 minutes to Toledo, over the Cleveland & Southwestern to Norwalk and the Lake Shore Electric to Toledo. From Toledo the car proceeded south over the Toledo & Maumee Valley Railway and the Toledo, Bowling Green & Southern route. Returning, the Cleveland car left Findlay at 6 p. m. The trip was made in one of the magnificent new cars of the Cleveland & Southwestern, which were illustrated in a recent issue.

SPECIAL CAR AND PARTY FROM CLEVELAND WHO ATTENDED THE CEREMONY OF OPENING THE NEW ELECTRIC LINE FROM FINDLAY TO LIMA

The first special from Dayton traveled over the Dayton, Covington & Piqua and Western Ohio lines, making an excellent run. In this party were E. C. Spring, superintendent, and R. D. Coburn, master mechanic, Dayton, Covington & Piqua; J. R. Harrigan, general manager, Columbus, Newark & Zanesville; Theodore Stebbins, general manager Appleyard lines; F. D. Carpenter, general manager, and J. H. Merrill, auditor Western Ohio; H. F. Dicke, superintendent Fort Wayne, Van Wert & Lima, and a number of others. The second party included H. P. Clegg, president; C. M. Paxton, traffic manager; R. A. Crume, auditor; W. E. Rolston, general superintendent; A. J. Ward, advertising manager of the Dayton & Troy; R. H. Carpenter, general passenger agent; J. Wilcoxson, superintendent; Charles Price, publicity man of the Western Ohio; F. J. Green, general manager, and J. W. Parker, superintendent Springfield, Troy & Piqua, and F. A. Ferneding, superintendent Dayton & Xenia. They made the trip over the Dayton & Troy routes.

J. Kilgore, vice-president, and W. L. Smith, general manager of the Toledo, Bowling Green & Southern, assisted greatly in the success of the affair, by taking care of arrangements at the Findlay end, and providing special cars for the parties from the south. During the afternoon the Cleveland party visited the new power station of the Toledo, Bowling Green & Southern, which is one of the finest in the State, and which was described in a recent issue of this paper.

In the very near future the Dayton & Troy, Western Ohio and Toledo, Bowling Green & Southern lines will commence operating limited service between Dayton and Toledo, 162 miles, this being made possible by the completion of the new line.

DECEMBER MEETING OF THE OHIO INTERURBAN RAILWAY ASSOCIATION

Interest in the Ohio Interurban Railway Association is increasing, and the attendance at the meeting held at the Chittenden Hotel, Columbus, Dec. 28, was the best which has ever occurred outside the annual meetings, when there are banquets.

J. C. Reese, of the Steubenville Traction & Light Company; E. J. Davis, of the Columbus, Buckeye Lake & Newark Traction Company; George Whysall, of the Columbus, Delaware & Marion Railway, and A. W. Jordan, of the Columbus, London & Springfield Railway, were admitted to membership.

President Spring reported on the plans for the annual meeting and banquet, to be held at Dayton, Jan. 25. A number of very prominent traction men have been invited and have promised to attend, and will probably make addresses. These gentlemen include H. H. Vreeland, president of the New York City Railway Company, of New York; T. E. Mitten, president of the Chicago City Railway, and W. Caryl Ely, president of the American Street & Interurban Railway Association. The Governors of Ohio and Indiana and prominent State and local officials have also been invited. The attendance will of necessity be limited to 200, and it is expected that fully that number will be present. Tickets to members this year will be $2.50 a plate, and it has been decided that the association shall take care of the entire entertainment without the financial assistance of the supply men.

Mr. Spring also reported that the committee from the Ohio Association which recently made overtures to the members of the Indiana State Association for a consolidation of the two organizations, had met with much encouragement and that the Indiana Association had appointed a committee of five to confer with a similar committee from Ohio. The latter committee, composed of E. C. Spring, Theodore Stebbins, H. P. Clegg, F. D. Carpenter and J. O. Wilson, will confer with the Indiana committee some time within the next two weeks, with power to act. In the event of the consummation of the plan, the annual meeting and banquet will be the first meeting of the merged association, which will probably be known as the Interstate Interurban Railway Association, and new officers will be elected at that time.

The nominating committee of the association adopted an alternative slate, which will be presented in the event that the two organizations do not get together. If, however, the merger plans are successful, the new list will include representatives from both States. The executive committee will probably be composed of ten men, five from each State, while it is probable that Ohio will have the selection of the president and secretary and Indiana the vice-president and treasurer. President E. C. Spring has been urged to accept the chief executive office of the new association if it is effected. It is felt that it is due to him on account of his strenuous work in the formation and accomplishments of the Ohio Association, and on account of his apparently successful labors in bringing about a consolidation.

Mr. Spring pointed out that in the event of the consolidation, the necessity for a permanent secretary would be more urgent than ever. He stated that sixteen Ohio companies had agreed to contribute $50 each toward the support of a permanent office, and at least ten more could be secured. He felt, therefore, that the success of the plan was assured whether the consolidation was effected or not, but in event that it is, the contributions of a dozen or more Indiana roads would add greatly to the efficiency of the office. A decision on this matter will be left until after the annual meeting.

INTERCHANGE OF CARS

Theodore Stebbins, of the Appleyard lines, asked that the subject of a uniform charge for foreign cars while on other roads be reopened and thoroughly threshed out. This has been discussed at several previous meetings but nothing accomplished. He said that the mechanical side of the controversy had been entirely ignored. Steps should be taken to compile information as to dimensions and sizes of cars and maximum clearances on all lines, so that it would be known in advance whether it was possible to run a car over another road and what the conditions were. He said also that the legal side of the question should be looked into. His attorneys had advised against allowing other cars on his lines, except under certain conditions to which some roads were unwilling to accede. He has frequent demands for such interline business, and thought it imperative that a standard form of contract should be adopted.

C. F. Wilcoxson, of the Cleveland & Southwestern, thought this was a matter which should be taken up by a permanent secretary, who would have time to compile full information covering all dimensions of cars and clearance on all connecting lines and have this tabulated and sent out. He thought the interurbans should take concerted action to secure wider devil strips in cities, because in many places it is impossible for cars of even a reasonable width to pass.

It was decided to table this subject for a later meeting.

A. W. Anderson, of the Dayton & Xenia Traction Company, was appointed treasurer to fill the unexpired term of R. E. DeWeese, of the Dayton & Northern Traction Company, who is ill and incapacitated for work.

ADVERTISING

The subject of the "Best Methods of Advertising" was discussed.

A. L. Neereamer, of the Columbus, Delaware & Marion, who introduced the subject, said that interurban roads could not do too much advertising, providing it was done in a judicious manner. He thought that many steam roads had gone to the extreme and were wasting money. Above all, he favored newspaper advertising, but he preferred to pay for short reading notices rather than display advertisements. Special advertising in college publications and programmes, according to Mr. Neercamer, was money wasted in the majority of cases, as many of them are simply fly-by-night schemes with no circulation or reliability. If special advertising was done, it should not be cheap. Calendars at the first of the year are good, providing they are attractive and legible. The average business man throws away all but one or two of the best. Hand bills and circulars distributed from door to door are not much account. In towns where there are no daily papers, he favored cards placed in windows; also cards on posts at country stopping points. He favored bill-board advertising for summer resorts where the business justified it. Locations for boards should be carefully selected and specified by the railroad company. Bill-posters have a trick of using isolated places for their long-time customers and keeping the good ones for transients. He thought it well to have a man inspect bill-boards occasionally to see that agreements were carried out. He thought souvenir buttons an excellent plan of advertising. A year ago his company put out a large quantity showing a car and the name of the line and points reached, and he said these were still being worn by many children. At this point Mr. were still being worn by many children.

F. J. Sloat, of the Cincinnati Northern Traction Company, spoke of a very attractive poster that had been published by the Detroit, Monroe & Toledo Short Line. He thought posters were an excellent method of advertising, and said that they should show plainly the route of the road but should not contain more printed matter than actually needed.

F. D. Carpenter, of the Western Ohio, said that local people on the majority of lines had learned the local points, but comparatively few people realized the great development of interline business and the long distances that could be covered at low cost. He thought all the individual roads should advertise the connections in every possible way, and that the association as a whole should take action to publish suitable guides and time tables. This was another subject to which the permanent secretary should devote considerable attention.

Theodore Stebbins argued against the tendency to cut rates in order to get long-distance business, and he especially deplored the tendency to make low rates and run special cars for such excursions.

F. W. Adams, of the Toledo, Fostoria & Findlay Railway, said that forty was the minimum number for which his company would run a special car, and then only a slight reduction was given. He did not see the necessity for the low excursion rates which have been advertised recently by some of the roads.

George Whysall, of the Columbus, Delaware & Marion Railway, thought there was not a sufficient interchange of advertising material among the various roads. He thought the steam practice of having time tables of uniform size and uniform racks in all stations should be followed. Few electric lines have such racks, and although the agents may have time tables of other roads, they are usually kept back of the desks and only given out when asked for.

J. O. Wilson, of the Cleveland & Southwestern, said they had issued time tables of steam road size and had distributed them liberally in all cars and stations. This was the best advertising with which he was acquainted. On the subject of reducing rates for special events, he thought it necessary at times to meet the rates made by steam roads, but frequently the latter make rates which it is folly to meet. Recently a college at Oberlin played a football game at Cleveland, and the competing steam road offered a special train with a rate of 75 cents for the round trip of 35 miles. He met this rate, and by the liberal use of cards and posters secured the business, his road hauling 326 people while the steam road had only twenty-four. On another occasion the steam road offered a special car with a baggage car for baggage at $24. He could not see any profit in it at that price and did not make any attempt to secure the business.

A. L. Neereamer, of the Columbus, Delaware & Marion, told of a similar experience. The steam road made a haul of 38 miles and sold a ticket which contained coupons for city car fare and admission to a park; it netted the steam road 23 cents round trip. He said: "I would not attempt to meet such a rate; but when you can meet their rate, advertise it well and you will get the business."

C. M. Paxton, of the Dayton & Troy Railway, said that in conjunction with the Western Ohio that company employs a publicity man who confines his efforts to reading matter and advertisements to the daily and weekly papers along the line. They are treated very liberally by papers in the matter of reading notices, display advertisements and time cards. Nearly every issue of these papers contains a display advertisement in addition to the time table, the advertisement usually filling 5 ins. or 6 ins. and more for special events. These are paid for entirely with transportation and by carrying papers free of charge. By this means the Dayton papers have been enabled to get their papers in all towns throughout a wide district earlier than the papers of other large cities, and their circulation has increased largely. They have not been imposed upon with requests for transportation. It is possible, however, that next year the papers may decide to pay for their advertising in cash and charge for transportation and papers. In any event, the company will continue to advertise liberally in all papers along its line.

F. W. Coen, of the Lake Shore Electric Railway, thought that clean, comfortable cars, fast service and keeping cars on time was the best possible means of advertising. In small towns he did not consider it necessary to advertise freely, so long as there was plenty of literature in the stations, but in the larger cities he favored advertising. In all cities and towns except Cleveland his company pays for time cards in papers with transportation. This is usually in the form of trip passes, which are taken up if presented by improper persons, but they are seldom misused. Mr. Coen believed in supplying news matter to newspapers and, wherever possible, photographs of interesting views and events.

E. C. Spring, of the Dayton, Covington & Piqua Traction Company, thought that in all advertising consideration should be made of the fact that the interurbans derived their chief revenue from the poorer and less intelligent classes. Advertisements should be made simple and legible. Stations should be designated by ample signs, and should be well lighted so that they can be found at night. There should be a large bulletin board in each waiting room containing notices of special events, also racks for time tables. He thought a calendar was an excellent advertisement, but said that it must be legible and, above all, attractive. He brought down the house and threw the young lady stenographer temporarily out of business by displaying a high-art production recently circulated by his company with the remark, "Could any man throw that away."

SHOP RECORDS

The subject "Shop Records" was introduced by J. C. Gillette, of the Columbus, Delaware & Marion Railway. He asked for expressions of opinion as to whether it was desirable to keep an accurate account of mileages on all parts and work on separate jobs, for an interurban road of, say, 50 miles. His company has no storekeeper, and in order to keep such a record it would be necessary to have a man who could devote his time to the work. The foremen of departments make daily reports of all material used, but they have no detailed reports or job cards. They have a daily car report, 3 ins. x 5 ins., which contains a statement of the condition of the car. This is made in duplicate and is signed by the motorman and conductor. One copy remains in the car for the car-house foreman and the other goes to the office. The foreman makes a note on this card of all light repairs, such as motor work, brake-shoe work, etc., and files the card in a card system. Then they have another 3-in. x 5-in. card, on which are reported all general overhauling, wheel and armature work, etc. One copy of this card goes to the main office and the other to the master mechanic. Mileages are taken from the train sheet and filed in a card system daily for each car. Mileages of car bodies and trucks are kept separately, as the company frequently shifts trucks. The company keeps mileages on certain wheels and brake-shoes. A record is also kept of oil, grease, waste, etc. This is footed each month and reduced to a 1000-mile basis from the mileage sheets. Mr. Gillette remarked that it was surprising what a variation there was in the life of brake-shoes; some shoes of the same makes and quality being as low as 50 cents per 1000 miles and others as high as $1 per 1000 miles.

A. M. Frazee, of the Columbus, Buckeye Lake & Newark Traction Company, said that they kept the standard Accountants' Association system of accounting. Each special job is kept on a card and charged against each car on a card index. The company has charge slips showing the cost of wheels, armatures, axles, journals, trolley wheels, car cleaning, etc., and reports are made on each monthly on a basis of 1000 miles. Gears and wheels are numbered and are charged to certain cars and checked off when they are replaced, so that an accurate record is kept of their life. His experience with brake shoes was the same as that of Mr. Gillette, except that the maximum was sometimes as high at $1.20 per 1000 miles.

L. C. Bradley, of the Scioto Valley Railway, said that from the first they had kept an accurate record of costs. In all they have twenty-five accounts in the material and shop department, which is considerably more than used by the Accountants' Association. In all cases of repairs or replacements, the electrical and mechanical work are separated. They have a casualty account, to which is charged labor and material for all work resulting from accidents while on the road, and such items are not charged to maintenance. He thought this plan more equitable to the master mechanic than charging all accidents to maintenance, as it did not necessitate explanations when the maintenance was unusually high. They do not keep an individual car expense account, and did not think it of sufficient importance to warrant the extra expense.

J. R. Harrigan, of the Columbus, Buckeye Lake & Newark Traction Company, asked Mr. Bradley how it was possible for him to determine the life of wheels and brake-shoes.

Mr. Bradley said that they made periodical tests of all such equipment, and in trying out new material or new lots of material they kept an accurate mileage. He thought that it was not always the part that gave the greatest mileage that was the most economical. They tested material with a view of ascertaining the effects on other material, the scrap value, etc. In general, they reduce quantities of material to the 1000-mile basis, but do not attempt to keep the actual mileage of each article that is used.

Form 77. 2 m. 9-05.

The Lake Shore Electric Ry. Co.

CAR MILEAGE RECORD.

.... 190

1		64	
2		65	
3		66	
4		67	
5		68	
6		69	
7		70	
8		71	
9		72	
10		100	
11		101	
12		102	
14		103	
15		104	
16		105	
17		106	
19		107	
20		113	
21		114	
22		115	
23		120	
24		200	
41		201	
42		202	
43		203	
44		204	
50		205	
51		5002	
52		5003	
53		5004	
54		5005	
55		5006	
56		5008	
57		5009	
58		31	
59		32	
60		33	
61		39	
62		K	
63		J	

.... AUDITOR.

(Front of Tag)

.... SHOP

Repairs made ....

Date .... Repaired by ....

(Back of Tag)

Inspector's Tag .... LINE ....

Car No. .... Truck No. ....

Trouble ....

Time .... Date ....

MILEAGE RECORD AND TAG USED BY LAKE SHORE ELECTRIC FOR KEEPING RECORDS OF MILEAGE AND REPAIRS

C. F. Wilcoxson, of the Cleveland & Southwestern, said he failed to see the distinction between expenses caused by natural wear and those caused by accidents. Other than so far as to report to the management the extent and causes of accidents, he saw no advantage in separating the accounts. The majority of minor accidents were due to the carelessness of trainmen, and he thought that repairs for such accidents were clearly an item of maintenance. However, the plan was interesting as showing what per cent of maintenance actually came from natural wear under normal conditions. He thought that small roads could not afford to keep accurate data of the life of all parts. Frequently items of expense were so small that they made no perceptible difference when reduced to the 1000-mile basis. He uses a card system for car reports and keeps an accurate record of all wheels and armature bearings, but not of smaller items. On trolley wheels and harps they make frequent tests and attach a card to the pole. This shows the life of the harp and bushing as well as the wheel. They have periodical tests on life of bearings, armatures, wheels, etc.; on wheels the value is determined by the cost of 1-16-in. turning per wheel.

F. W. Coen said the Lake Shore Electric uses a card system. Cars are inspected regularly and the inspector attaches to the car a small tag containing space for the inspector's number, line, car number, truck number, description of trouble, time and date. On the reverse side of the tag is the name of the shop, description of repairs made, date and signature of man in charge of the job. The train despatcher makes a daily report of the mileage of each car, and this, together with the card mentioned, is filed under each car number. (This tag and mileage record are reproduced herewith.)

Mr. Frazee said that they charged casualties to maintenance, but made a special report to the office and the office keeps an account of the nature and cost of damages. They have an inspector who gives a daily inspection to all cars and makes a report of all requirements, his card list showing the conditions of all parts of the car daily. Work in the shop is divided between four men or four classes of men, each man taking care of a certain class of work and being responsible for that only. Material for these classes of repairs are charged to the individual who takes care of the particular class of work. The car record must be checked off by each man, and no car is allowed to go out on the road unless in perfect operating condition. Where there is trouble or an oversight, the neglect can be charged directly to the individual.

Mr. Gillette said that in their shop, work was given out to men in pairs who worked together and performed all the necessary work, except that car cleaning, trolley oiling and stove replenishing were designated to a special man.

TRANSPORTATION OF EMPLOYEES

The subject "Transportation of Employees and Dependents" was particularly pertinent at this time, when a number of the steam roads are greatly reducing the number of passes to employees. One of the largest electric systems in this State has recently adopted the same policy, and the manager who defended this position was strongly criticised by the majority of managers. The gentleman in question took the position that an electric road was no more under obligations to furnish employees and dependents with free transportation for pleasure purposes than was a grocer obligated to furnish free supplies to his employees. The general sentiment was that this was not a parallel case.

Theodore Stebbins, of the Appleyard lines, said that when he first took charge of the properties, there was practically an unlimited supply of passes for all employees and no records were kept. He instituted a number of restrictions and records which are valuable and interesting. He operates six different roads and has about 400 employees. At present they use 15,000 to 18,000 passes per month and travel 110,000 to 125,000 miles per month. This he thought too much. He has recently adopted the form of employees pass which is illustrated herewith. It shows the points from and to, and has space for the signature of the employee, train number and conductor's number, and it is punched between certain points. In some cases a man is permitted to ride over any of the roads, while in others the points are designated by punch marks before they are given out. Records are kept of when issued, when used and distance traveled, and these are in tabulated form, so that it is possible to determine whether a man travels more than is necessary. This gives a good check on how roadmen, particularly inspectors, are attending to their duties. Superintendents inspect the signatures frequently to determine that the passes are not abused. Comparatively few passes are issued to families of employees; requests do not average more than one a day for the entire system, and these are seldom refused. The transportation of section men is quite a problem. Formerly one road 50 miles long had three sections. This has been increased to five and the men provided with hand-cars, which eliminates passes and keeps the men out of the cars. Where section men are moved from one point to another, the superintendent supplies them with two pass slips each night. The pass slips cost 35 cents per 1000, and are cheaper and more convenient than card passes in combination with "dead head" slips.

Mr. Sloat, of the Cincinnati Northern, said they had recently adopted a form of mileage similar to the standard coupon book which is issued for advertising and to certain employees. Strips are pulled out to cover the regular fare. He is endeavoring to find a flexible form of transportation to take care of track and trainmen, but finds it difficult.

F. W. Coen said that the Lake Shore Electric Railway issued no card passes of any kind. Annual passes for employees are put up in books of fifty coupons. One side contains the restrictions and number, and the reverse side contains the stations from and to. Conductors must have something to show for every passenger. The cover contains a contract and release clause and the signature of the holder; no "dead head" slips are used. Books are not good on limited trains, but in certain cases a card authorizing the conductor to accept them on such trains is issued. A record is kept of the books, and if abused they are called in. The company is very liberal with dependents of employees. Trip passes are issued by the superintendent or division superintendents and department foremen practically whenever asked for. The company feels that the men spend the best part of their lives in their work, and that they are entitled to every reasonable consideration. One of the division headquarters is in an isolated town where no supplies can be purchased, and it would be a great hardship for the families to be obliged to pay for transportation.

C. F. Wilcoxson shared this opinion. He thought that if men were refused transportation they would beat their way, and the temptation to break rules covering this point would lead to infractions of other rules. Trainmen, shopmen, etc., have issued to them monthly books with a sufficient number of coupons for actual working days. Stations are printed on them, and in case of some men they are punched in advance; others may travel anywhere on the road. Coupons must be signed on the back. Passes for wives of employees only are issued by the superintendents, and the dependents of single men are not refused.

E. C. Spring said he believed in liberality to families of employees. He referred to one particular case where a wife of a motorman and a sick child had been carried to and from Dayton every day for several weeks.

A. W. Anderson said they frequently asked men to perform extra and hazardous duties for which they gave no extra compensation, and the least they could do was to be liberal in transportation, which actually cost the company nothing, as the cars ran anyway. They issue passes to all dependents of employees, and much prefer that a man ask for a pass than have his wife "dead headed" by some other employee. Employees' passes are contained in books issued monthly. These passes are signed on their face and the points are indicated by punch marks.

Mr. Whysall said he believed in liberality, but his company declined to issue trip passes on Sundays and holidays, when the loads were heavy. Passes for the majority of employees are good only between certain points.

Mr. Adams told a story of an Irish brakeman, who asked his superintendent for a pass to go home on Sunday. The latter said, "If I were a farmer and you my hired man, would you expect me to hitch up and take you to town?" "No," said Pat, "but if you were hitched up and going to town, I'd think you a d—— mean man if you wouldn't give me a ride." Mr. Adams said that was his position exactly.

The Scioto Valley Traction Co.

Employes Ticket

Name ____________

From ____________

To ____________

Date ____________ 190__

Good only when officially signed and stamped on cover hereof for one continuous passage on trains stopping at last named station.

VOID IF DETACHED

No. E 160 L. C. BRADLEY, SUPERINTENDENT

Front

CONDITIONS.

This ticket is not transferable, and is void if presented by any other than the person named, or if any alteration or addition is made upon it. The person accepting and using this ticket, in consideration of receiving the same, voluntarily assumes all risks of accidents and damages and expressly agrees that The Scioto Valley Traction Company shall not be regarded as a common carrier, nor as liable to him for any injury to his person which may occur while using this ticket whether caused by negligence of the Company's agents or otherwise.

Back

FROM	TO	FROM	TO
ROCKY	RIVER	HUR	ON
EAGLE	CLIFF	MONRO	EVILLE
BEACH	PARK	BELL	EVUE
LOR	AIN	CLY	DE
VERMI	LLION	FREM	ONT
CEYLON	JUNCTION	GIBSONBU	RG JUNCT.
BERLIN	HEIGHTS	GIBSO	NBURG
NORW	ALK	WOOD	VILLE
MIL	AN	GEN	OA
SANDUSKY	CITY LTS.	TOLEDO CI	TY LIMITS
SANDUS	KY CITY		

Back

The Lake Shore Electric R'y Co.

FREE PASS. 1905.

This Free Pass is good only for person whose name appears on cover of this book. Conductors will refuse to accept same if presented by any other person. Subject to rules on second page.

216

F. W. Coen, GEN PASS AGT.

Front

FORM 504 CONDUCTORS PUNCH H

Employes TRIP PASS No. 16502

I hereby certify that I am an employe and present this Pass for transportation

FROM ____________

TO ____________

(WRITE NAMES OF STATIONS.)

In consideration of this free transporation I hereby assume all risk of accident or damage to person or property and NOW sign in presence of Conductor.

____________ USER.

Signed before me on Train No.________ on ________th of the below (or preceding) month.

____________ Cond.

Conductors will honor this Pass only between stations within limits punched (if any are punched.) Collect one pass on each division.

Dayton	Osborn	N. Carlisle	Medway	Springfield	Urbana	Bellefont'ne
London	West Jeff.	Columbus	Grove City	Morgans	W[illegible] ork.	Cols., MorGC

VOID AFTER DEC. 31, 1905.

(RETURN UNUSED PASSES AT END OF EACH MONTH.)

Train	Track	Line	S.Sta	Shop	P.H.	Cons( )

RECEIVERS CLS CGC-SW CM DSU UBN

[signature], GEN. MANAGER

THREE FORMS OF EMPLOYEES' FREE-TRIP TICKETS GIVEN BY OHIO INTERURBAN ELECTRIC RAILWAYS

INTERLINE TICKET

Mr. Sloat, chairman of the committee on a new form of interline ticket, presented a form of multiple-destination ticket which he believed overcame the objections offered at the Youngstown meeting, and which were outlined in the issue of the STREET RAILWAY JOURNAL for Dec. 9, 1905. As stated then, it was considered desirable to have a form of interline ticket which would show the point of sale and destination on each coupon, so that each road would have this information without waiting for a monthly report from the selling road. The ticket contains the contract on the upper end, and at one side the year, month and day to be punched for time limit. The contract is the same as that used in the skeleton form of interline ticket which was illustrated on page 92 of the STREET RAILWAY JOURNAL for Jan. 14, 1905, except that a sixth clause is added which provides that where used on limited cars, an excess fare may be collected according to the rules of the company collecting the coupon. Attached to the main part of the ticket are the several coupons. One of these coupons, collected by the final company, is illustrated on page 36 to give an idea of the character of the form used. This coupon contains the principal stations on several routes radiating from a large terminal city; also the route. Where the ticket is for a station not designated, the agent fills in the blank space in the center. All tickets have at the bottom an agent's stub, which is of the same size as the other coupons and contains space indicating the amount paid by the passenger. This space is filled in by the agent when the ticket is sold. There are two, three or four intervening coupons for various routes over which a ticket is likely to be sold and each coupon has the name of the collecting road printed on it, with the terminal city of that road. Each coupon also bears the list of the selective routes and towns for the final destination. In selling the ticket the agent folds the ticket between each coupon so that the station lines register under each other and punches the desired destination and route. The ticket is good from the point stamped on the back to the destination indicated, and, as stated, each coupon shows these points. Half-fare tickets will probably be indicated by a suitable punch mark so as to eliminate separate colored tickets. Round-trip tickets will be of the same general character, except that they will have double the number of intervening coupons and will be white, while the single trip will be green. Water-marked safety paper will be used. It is not intended that this new coupon ticket shall entirely supersede the skeleton form of ticket adopted some time ago and now in general use, but the new form will be used by those that desire it, and its chief advantage lies in the fact that it can be issued more quickly than the other ticket. On the other hand, it is not as practical for long routes over more than three or four roads on account of the inability to print a large number of routes and towns in a small space.

Issued by The Columbus, London & Springfield Ry. Co.
DAYTON
To POINT BETWEEN PUNCH MARKS.
Via ELECTRIC LINE DESIGNATED.

ARCANUM, O Via D&N
Cincinnati, O Via CD&T
Covington, O Via DC&P
EATON, O Via D&W
FRANKLIN, O Via CD&T
Greenville, O Via D&N
HAMILTON, O Via CD&T
Middletown, O Via CD&T
New Paris, O Via D&W
PIQUA, O Via DC&P
PIQUA, O Via D&T
Richmond, Ind Via D&W
Tippecanoe City Via D&T
TROY, O Via D&T
W. Alexandria Via D&W

On Conditions named in Contract.
VOID IF DETACHED.
Via CL&S, DS&U and EL designated.
FORM C 1

SAMPLE COUPON OF SELECTIVE INTERLINE TICKET. THIS COUPON IS TO BE COLLECTED BY FOREIGN ROAD

On vote, the ticket was authorized, and Mr. Sloat was instructed to make a few minor changes that were suggested.

A NEW METHOD OF REBATING

The Illinois Valley Railway Company is issuing a coupon commutation rebate book, having a sliding scale of rebates somewhat out of the ordinary. The book, which contains 100 coupons, each having a face value of 5 cents, sells for $5, or at the face value of the coupons. If used within thirty days from date of sale a rebate of $2 is made upon the surrender of the cover. If the cover is returned within sixty days, the rebate is $1, while a rebate of 50 cents is made if it is returned within ninety days. This method of rebating avoids the use of several books of different values, yet gives to those using the road extensively a cheaper rate than the casual traveler.

The Toledo, Port Clinton & Lakeside Railway is about to inaugurate limited service between Toledo and Marblehead. The distance is about 50 miles, and the time will be 1 hour 45 minutes, of which 23 minutes are required in getting out of Toledo. There will be three limited cars each way daily.

NEW YORK STATE JANUARY MEETING

As stated in the last issue of the STREET RAILWAY JOURNAL, the first quarterly meeting of the Street Railway Association of the State of New York has been called to convene in Schenectady, N. Y., on Jan. 10, for the discussion of mechanical subjects. President Danforth states that the replies received in response to the official notice forecast the complete success of the meeting. The attendance of mechanical men from New York State and the adjoining territory promises to be large and representative, and the interest manifested indicates good results from the conference. As stated in the circular, the meeting will be called at 9:30 Wednesday morning, Jan. 10, in the rooms of the Schenectady Railway Benefit Association, at the Fuller Street station, Schenectady, N. Y. It will be continued throughout the entire day and will be devoted to a discussion of topics included under Accounts 6, 7, 8 and 9, namely, maintenance of cars and equipment. Short papers will be presented on "Cleaning and Handling Cars in Car Houses"; "Lay-Over Inspection vs. Night Inspection," and "Car Maintenance," and opportunity will be given for asking and answering questions relating to any of the topics covered by the mechanical department. There will be no entertainments, no exhibits, no supply men, and absolutely nothing to detract from the serious work of the conference. A light buffet luncheon will be served in the middle of the day at the expense of the association. Representatives of mechanical departments and also of operating departments, both in New York State and outside of the State, whether members or not, are cordially invited to attend this conference and take part in the discussions.

FIRST ANNUAL MEETING OF THE PORTLAND (ORE.) RAILROAD COMPANY'S RELIEF ASSOCIATION

The first annual meeting of the relief association of the Portland Railroad Company, of Portland, Ore., was held recently at the St. John car house, with a large attendance representing nearly all the divisions of the company. The annual reports were presented, showing the association to be in excellent financial condition. President Jesse C. Estes in his report gave the following facts: The total membership is 102, four having dropped out by reason of leaving the employment of the company. Nine claims for sickness and disability have been paid amounting to $132.84, one claim being for the full amount of $60. The amount of $168.84 is on deposit in the Casco Bank. George A. Milliken, the treasurer, reported as follows: Receipts for the year, $399; payments for the year, $230.16; balance on hand, $168.84. The following directors were elected to serve for the next year: J. C. Estes, E. H. Belyea, C. M. Durell, W. A. Worthing, J. Frank Babbidge, N. P. Grant, Charles D. Bayd, F. G. Carey, F. H. Knight, George A. Milliken, Merrill E. Crossman, F. R. Larrabee.

Shaft bearing practice is tending toward higher temperatures, according to A. M. Mattice, who stated in the topical discussion upon bearings at the recent New York meeting of the American Society of Mechanical Engineers, that in his examinations of large numbers of engines in service, he has found more bearings hotter than 135 degs. F. than cooler. In many cases, temperatures as high as 150 degs. F. are operated under constantly without trouble, while one instance of an operating temperature of 180 degs. F. was cited. Where engines are direct connected to generators, the bearings are subject to much greater rises of temperature than in other classes of machinery, as the proximity of the heated generator and other parts prevent the ventilation that is necessary for proper cooling.

CORRESPONDENCE

THE LOCATION OF TOILET AND SMOKING ROOMS

San Jose, Cal., Dec. 18, 1905.

EDITORS STREET RAILWAY JOURNAL:

I have noticed the suggestions being made in your paper as to the proper locations of toilet and smoking compartments on interurban cars. I have had considerable experience in the practical operation of interurban cars, and am very much in favor of the single-ended car, as a large controller and other appliances on the rear platform take up considerable room that might be otherwise utilized for passengers when the cars are crowded. For a single-ended car I believe that the smoking compartment should be placed in the forward end of the car, with its entrance from the front platform in the right-hand corner of the platform. The motorman's cab should be triangular in shape and in the opposite corner of the front end of the car. The door by which it is entered would normally be kept closed.

Now, as to the toilet, I suggest that it be placed at the rear of the car on the left-hand side, and that the heater be placed directly ahead of it; this would make a very compact arrangement. I would also advocate cross-seats throughout the car.

WILLIAM COULTER.

OIL FOR MOTOR LUBRICATION

GALENA-SIGNAL OIL COMPANY

Franklin, Pa., Dec. 21, 1905.

EDITORS STREET RAILWAY JOURNAL:

Having read the discussion in your journal on "Oil vs. Grease for Motor Lubrication," I desire to make a few statements in regard to some of the difficulties existing and to be overcome in the introduction of oil lubrication, in order to get the best results.

Much has been said in regard to methods of application and various types of cups for feeding the oil to the motor bearing. Admitting that a good quality of oil is the first essential, and that a good cup is an indispensable device in oil lubrication of motors with bearings designed for grease, it is nevertheless a fact that in many instances one of the most important factors is overlooked, namely, that of familiarizing the inspectors and oilers with the necessary difference in the care and attention required in the use of the two lubricants. It can truthfully be said that many failures with oil lubrication or inability to get as good results as are known to have been secured elsewhere can be accounted for in the lack of interest taken by those making the trial test. To do anything correctly or successfully means that the work to be done must have the attention of an interested person. Then when a change from grease to oil is contemplated, the oilers or other car house men directly in touch with the work of equipping the motors must at least have that interest necessary to an impartial trial. If the above rule is not followed, the master mechanic will often find that the "object" he sought to obtain has been defeated in advance. I mean by this that when a good method of oil lubrication has been adopted there is less work in caring for the electric equipment in every way than when grease was used, but to convince the pitmen of this fact is often a difficult task, as to them any change ordinarily suggested in shop practices is interpreted to mean either an additional amount of work for them or a reduction in the number of employees.

As to the amount of oil required for different types of motors, I am of the opinion that where a good quantity of oil is used, which is one of the principal features and should be considered before everything else, that if fed regularly and at such a speed that it will not flood the interior of the motor, the quantity required to lubricate one motor will not be greater than another where the speed and horse-power are equal. This will be readily understood when it is explained that 2 oz. of oil is taken as a basis for the minimum quantity per armature bearing per 1000 miles, and 1 oz. of oil per motor axle bearing per 1000 miles.

Where the oil enters the motor in such quantities as to cause trouble, it is evident there is something wrong with either the kind of oil used or the quantity fed, and I would consider such practices expensive, as when such a large quantity of oil is entering the motor more is being lost on roadway.

The difficulty experienced in the past in lubricating the G.E. 800 motor is now successfully overcome by constructing an oil cup with the top projecting above the top of the grease receptacle, with a male lug cast on it for holding the oil lid and another female lug for fastening the cup to the motor with a cotter pin by means of the original male lug which held the cover, thus increasing the capacity for oil. The large number of electric lines, both interurban of high speed and long runs and city lines of slow speed and short runs, which bear testimony to the superiority of oil over grease for motor lubrication is sufficient to convince the most erratic unbeliever. The best argument in favor of oil lubrication is found in the saving of power consumed per car.

W. H. PAPE.

NOTES ON THE COMMERCIAL VALUE OF EFFICIENCY

27 William Street, New York, Dec. 28, 1905.

EDITORS STREET RAILWAY JOURNAL:

It may be of some interest to note that roughly the value per kilowatt of an average decrease or increase of efficiency in a power plant is approximately the cost of 1 ton of coal. This rule of thumb is derived as follows: Assuming the plant to be in operation during eighteen hours each day, and that the average output during these eighteen hours is 50 per cent of the full load capacity, there would be 3310 kw-hours generated per annum for each kilowatt installed. With a coal consumption of 3 lbs. per kw-hour the annual coal consumption per kilowatt installed would be 9930 lbs., and a decrease or increase in average efficiency of 1 per cent would amount to a decrease or increase of 99.3 lbs., or 0.04965 ton of coal consumption per annum. This capitalized at 5 per cent would amount to 0.993, or approximately 1 ton of coal.

The more economical the coal consumption the less is the value of the efficiency of the apparatus. As an example of this, where gas engines are installed as prime movers, the value of 1 per cent in efficiency would be only approximately ½ ton of coal. In other words, comparing a gas engine plant with a steam engine plant, the efficiency of the electrical apparatus is of relatively small importance, and this is a point which should be considered in weighing the relative advantages of the two forms of prime movers.

F. A. GIFFIN.

IMPROVEMENTS IN SAN FRANCISCO

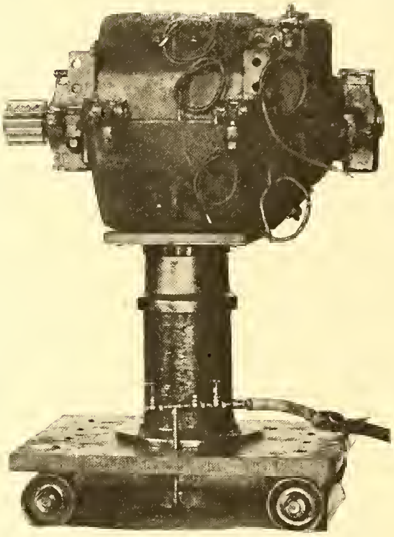
General Manager Chapman, of the United Railroads of San Francisco, has announced the details of a number of radical changes in the car service on various electric railways which he plans to inaugurate in the near future. New routes of travel for the better accommodation of residents in various outlying districts, better transportation facilities on a number of lines, the extension and betterment of the owl-car service and other like innovations are contemplated. One notable improvement decided upon is the inauguration of a through-car service to various outlying districts now reached only by transfering from one line to another. Various track connections to permit the operation of through lines over new routes have recently been completed, and the company will endeavor to demonstrate by its improved car service the advantages of an interchangeable system, which is one of the arguments in favor of a trolley line for Sutter Street.

NEW PIT JACK AT THE SHOPS OF THE INTERNATIONAL RAILWAY COMPANY

John A. Hanf, master mechanic of the International Railway Company, Buffalo, N. Y., has designed and built a novel form of pit jack for use in the repair pits of the company's Cold Springs shops. In considering the problem of fitting these shops with an efficient and at the same time economical type of jack, it was found that there were practically but two alternatives open, either to install the old style hand lever jack mounted on a truck or to adopt one of the several types of hydraulic air jacks now on the market. The idea of installing hand jacks was finally rejected as too slow and cumbersome and out of keeping with the intention to fit these shops with only the most up-to-date economical and serviceable tools. An examination of all the various forms of power jacks presented showed that to operate any of them in these particular pits, where the headroom is low, it would be necessary to have a trench in the bottom of the pit to give room for the cylinder piston when the jack table was in its low position. This trench in the pit was considered an objectionable feature in view of the likelihood of its becoming more or less of a catch-all for grease, old waste and rubbish, in addition to its hampering the pit men in their work.

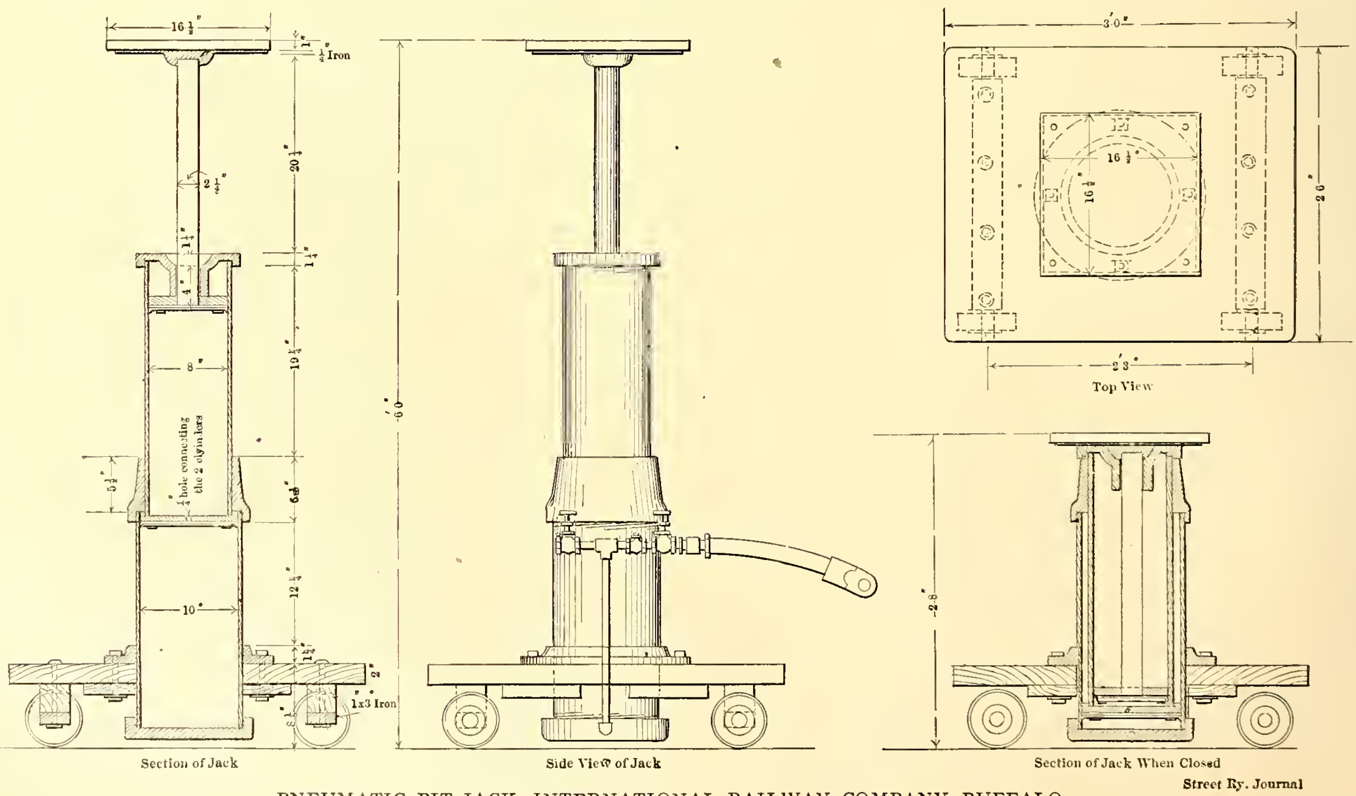
While considering this problem, Mr. Hanf conceived the idea of constructing a jack which would operate with telescoping pistons so that the necessary limits of travel could be secured without trenching or cutting the bottom of the pit. The type of jack finally designed is illustrated in the engravings. The table of the jack when lowered is but 32 ins. from the pit bottom, and when raised to its maximum height is 5 ft. 11 ins., giving a total piston travel of 3 ft. 3 ins. The jack requires no trench and takes up much less room than lever jacks. The jack shown is operated by air where air is obtainable. The same design, however, can be arranged to work with hydraulic pressure equally as well.

By reference to the drawings it will be seen that the lower cylinder consists of an iron shell about 10 ins. in diameter mounted in a small truck. The second cylinder is 8 ins. in diameter and telescopes into the lower cylinder. There is no packing between these two cylinders at the sides, the sliding contact being merely a good machine finish fit. At the bottom of the 8-in. cylinder, however, there is a steel plate with a leather gasket packing. The only passageway for air between the 10-in. cylinder and the 8-in. cylinder is a hole $\frac{1}{4}$ in. in diameter bored through the bottom of the smaller cylinder and through the steel plate and leather packing. This small hole serves all the requirements of an air valve from the lower cylinder into the upper one. The jack table is carried on a shaft $2\frac{1}{4}$ ins. in diameter made from an old car-wheel axle. This shaft telescopes into the 8-in. cylinder and has a circular plate at its lower end, as is shown. The sliding surfaces where the shaft passes through



JACK IN LOWERED POSITION

TELESCOPIC JACK RAISED TO MAXIMUM HEIGHT



PNEUMATIC PIT JACK, INTERNATIONAL RAILWAY COMPANY, BUFFALO the top of the 8-in. cylinder are packed with air-tight bushings.

The air supply is let into the bottom of the lower cylinder, the flow of air being controlled by a small hand valve. When air is allowed to enter, the 8-in. cylinder begins to rise first until it has reached nearly its maximum height, when the air begins to flow through the $\frac{1}{4}$-in. hole into this cylinder, and the third section, comprising the shaft with the jack table, then begins to rise. The jack is lowered by closing the valve to the air supply and opening a small valve, giving exhaust to atmosphere. The raising and lowering of the jack are easily controlled by manipulating the two hand valves, and the table can be stopped and held at any point in its upward or downward travel. If it is necessary to leave the jack in its raised position with a heavy weight on the table for any length of time, this can be accomplished by closing the exhaust valve and opening the air supply valve just a trifle so that sufficient air from the main supply tank will flow in to compensate for any slight leakage or compression of air in the jack cylinders.

The 8-in. cylinder has a lifting capacity, when operated with air at 60 lbs. pressure, of 4700 lbs., and raises to a height of 52 ins. The smaller piston raises to the full height of 5 ft. 11 ins., and when operated with air at 60 lbs. will lift about 3000 lbs., supported on the jack table. The engravings show the jack lifting a GE 67 motor, complete with armature, fields and pinion. Mr. Hanf has applied for patents covering the details of the jack.

A CAR FOR LIMITED PASSENGER SERVICE

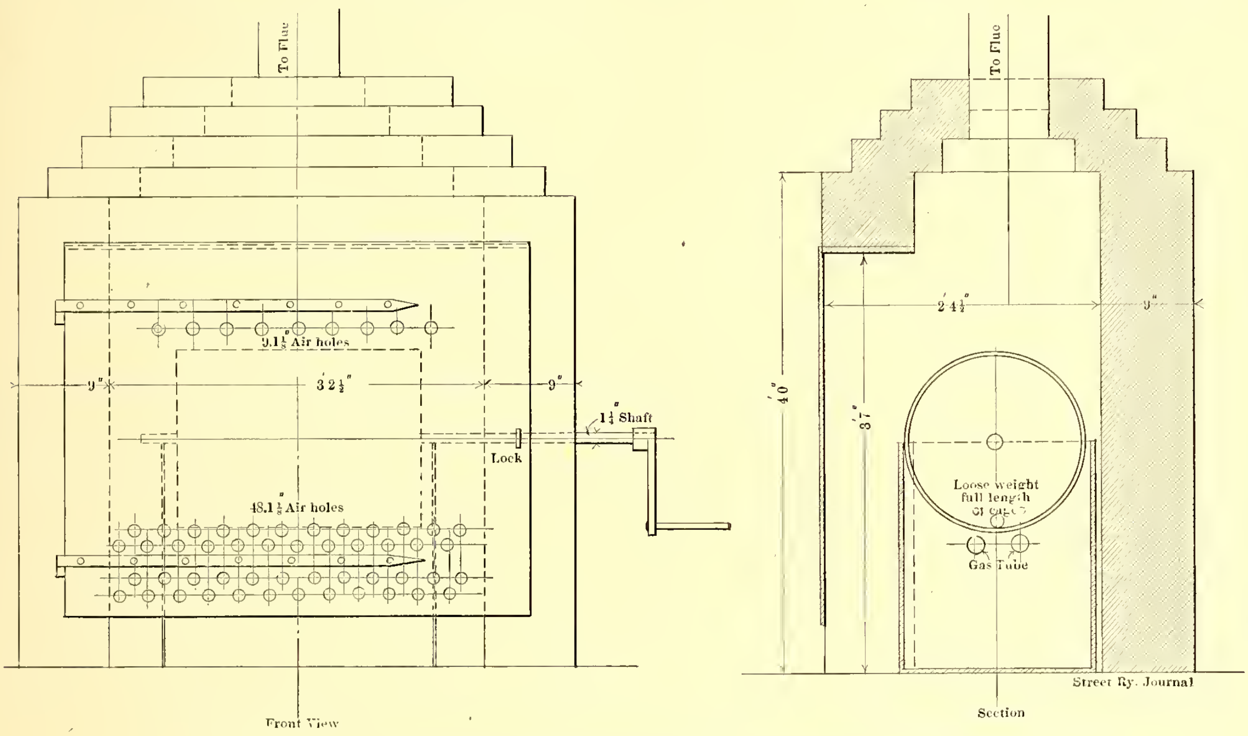
A car intended for limited service only on the lines of the Indiana Union Traction Company is being reconstructed in the shops of the company. The present limited cars have buffet heater and toilet rooms located at the partition between the main passenger and smoking compartments. In order to give passengers in the rear compartment a clear view ahead, these have been removed from their present location and a glass partition constructed. The heater and toilet rooms are located at the rear entrance of the car, and the buffet has been abandoned. The feature most worthy of note in the new car is the revolving chair seats employed. General Manager Nicholl states that if the first car is found satisfactory more will be built.

CONVENIENT ARRANGEMENT FOR DESTROYING USED TICKETS

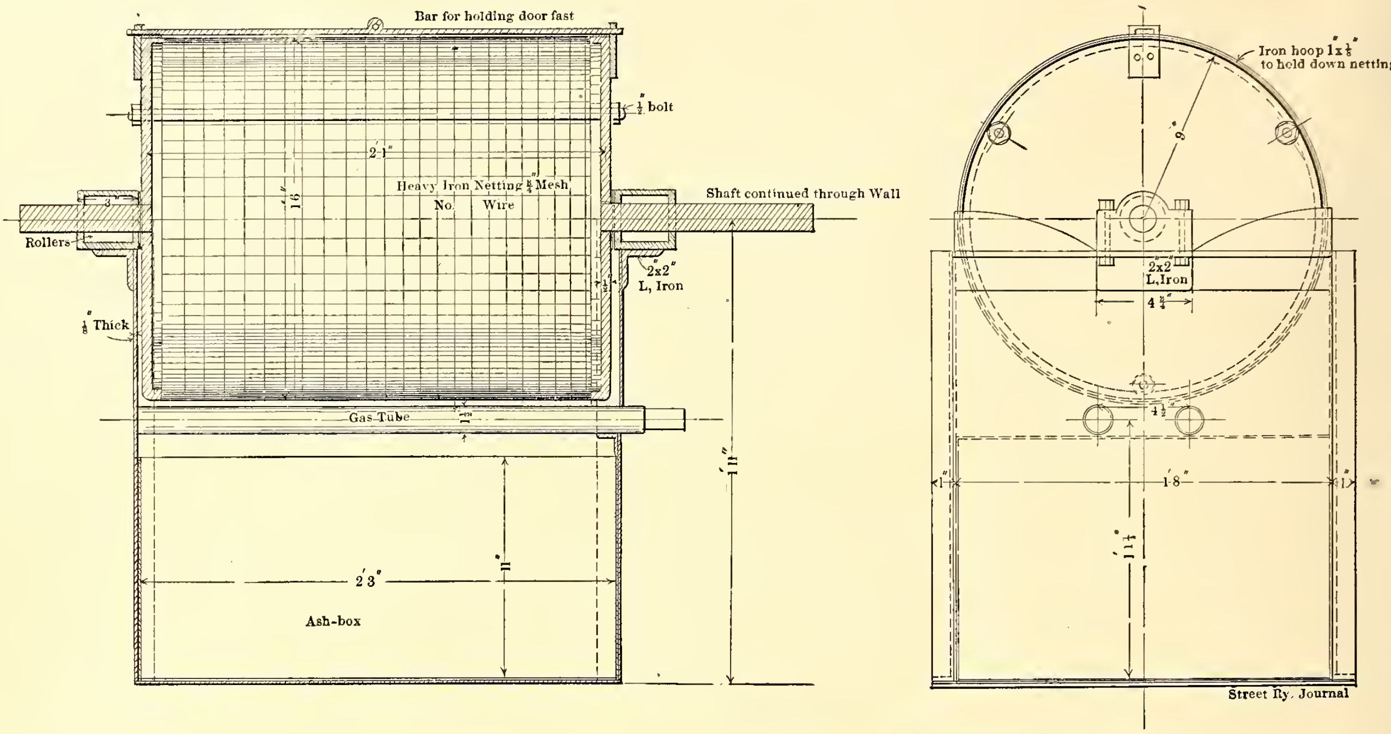
Although seemingly a simple matter, it is oftentimes a vexing question to decide how best to destroy used tickets and transfers. Of course, it is easy enough to send a clerk from the accounting department with the tickets in bags and have them dumped into the furnace under the boilers at the power house, but a number of companies have found to their cost that this procedure leaves too many loopholes for the tickets to find their way back into the hands of the public, and it is now generally considered necessary to place as many safeguards around the tickets from the time they reach the accounting department until they are entirely destroyed as is exercised in handling the cash.

The Toronto Railway Company has devised a scheme for destroying tickets that is at once simple, economical and safe. At the side of a small furnace used for heating the office building in which the accounting department is housed has been built a small brick retort about 5 ft. high, $4\frac{1}{2}$ ft. wide and 3 ft. deep, inside dimensions. Within this furnace is a cylinder formed of heavy iron netting with $\frac{3}{4}$-in. mesh, this cylinder being not unlike the ordinary wire screen used for screening broken stone. The cylinder is carried on bearings housed in the side walls of the retort, and can be revolved by means of a shaft and hand crank which project outside one of the walls. The cylinder, or screen, has a hinged section or top, through which the tickets or transfers enclosed in paper bags are packed tightly inside the cylinder. This hinged door is then closed, and locked, so that it is impossible to remove the contents without a key. Underneath the cylinder are a number of gas jets formed by punching holes in two iron gas pipes, which extend the full length of the cylinder about an inch below the bottom. The furnace itself has a heavy iron door which is fitted with a heavy padlock.

The procedure is for the cashier and one assistant to take the tickets, after they have been counted and placed in paper bags, down to the cellar and pack them into the wire cylinder. The cylinder is then closed and locked, and the furnace door is also closed, bolted and locked. The assistant then lights the gas jets under the screen, and after the flames have communicated to the paper bags the crank handle is given a few quick

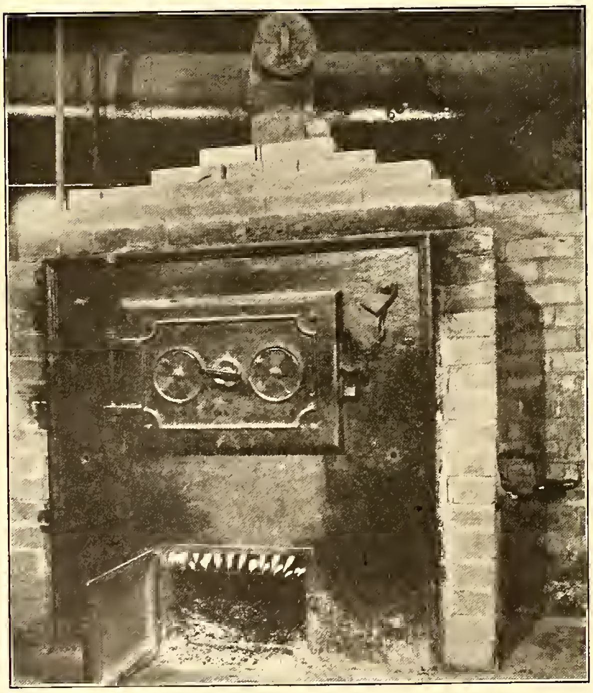


DETAILS OF FURNACE FOR BURNING TICKETS, TORONTO RAILWAY COMPANY turns, thus revolving the contents of the cylinder and permitting the flames to pass through the entire mass. The gas is left burning for an hour or so, but it is not necessary to leave anyone to watch the furnace after the door has been locked, as it is manifestly impossible for anyone to gain access few turns. In the several years this device has been in use, a piece of paper bearing any semblance to a ticket has never passed through the screen after the firing, and the officials of the accounting department never have the slightest doubt about each individual ticket being destroyed after it has once been

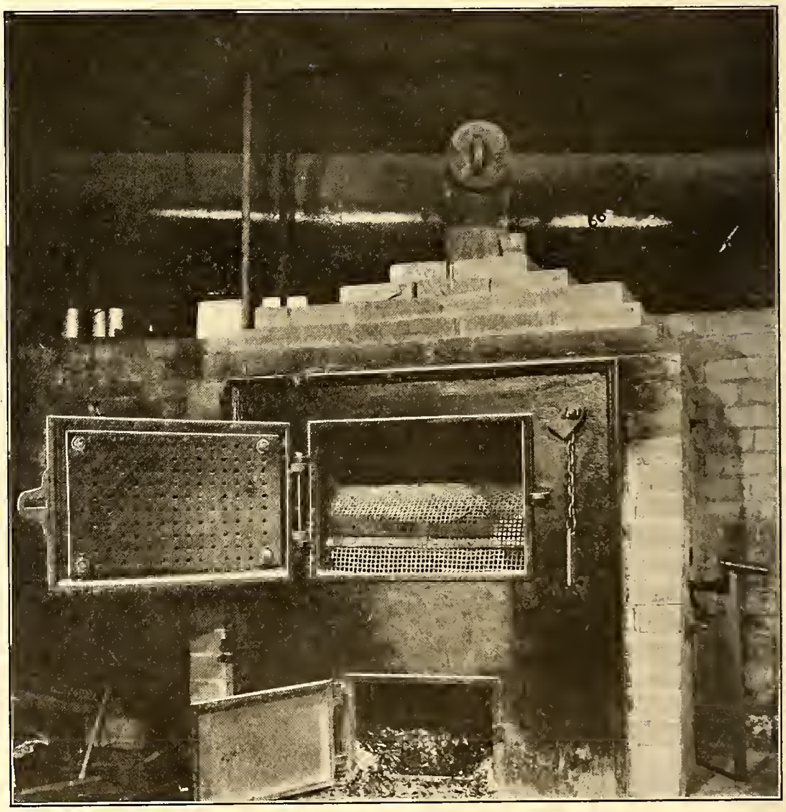


DETAILS OF SCREEN CYLINDER OR CAGE IN WHICH TICKETS ARE PLACED FOR BURNING

to the interior of the screen. To facilitate the destruction of the tickets it has been found expedient to place a loose iron bar within the cylinder, so



FURNACE FOR BURNING TICKETS, SHOWING GAS JETS UNDERNEATH CAGE, TORONTO RAILWAY COMPANY



FURNACE FOR BURNING TICKETS, SHOWING SCREEN CYLINDER OR CAGE IN WHICH THE TICKETS ARE PLACED, TORONTO RAILWAY COMPANY

that when the handle is turned the bar will roll around within the screen and thoroughly break up any small masses of tickets that might form and escape the full effects of the flames. The residue of a charge of tickets after burning for an hour comprises a handful of black dust, which can be readily sifted through the screen by giving the handle a placed within the screen. The time consumed by a responsible representative of the accounting department in overseeing the destruction of the tickets amounts simply to the time necessary to take the tickets to the cellar, pack them in the screen cylinder, lock the doors, light the gas jets and give the cylinder handle a few quick turns. The cost of destroying the tickets amounts to the expense of burning the gas jets under the cylinder for not over an hour each day. The illustrations accompanying this article give all the details and dimensions of the ticket destroyer. For the drawings and photographs acknowledgment is made to J. H. Smith, comptroller, and Robert J. Clark, assistant comptroller, of the Toronto Railway Company. It is the intention to take out letters patent covering the details of the device.

REPORT OF THE OFFICIAL TEST OF THE DOUBLE CROSS-COMPOUND ENGINES IN THE FIFTY-NINTH STREET POWER STATION OF THE INTERBOROUGH RAPID TRANSIT COMPANY OF NEW YORK

In accordance with the terms contained in the contract between the Allis-Chalmers Company and the Interborough Rapid Transit Company, governing the construction and operation of the nine double cross-compound engines in the latter's power station at Fifty-Ninth Street and Eleventh Avenue, New York, the former guaranteed certain operative results under specified conditions, in effect as follows:

Each engine was not to require more than 12.25 lbs. of dry steam per ihp per hour, when indicating 7500 hp at 75 r. p. m., with a vacuum of 26 ins. at the low-pressure cylinders, and with a steam pressure at the throttle of 175 lbs., said rating to include all steam used by the engine or by the jackets or reheater. A further memorandum agreement formulated by the representative engineers of each company governed in detail the conduct of the test; this secondary agreement being necessitated by certain features peculiar to the case involving the very essential point of the original contract.

The swing of the generator load, averaging approximately 12 per cent in three seconds plus or minus, presented a prohibitive impediment to the use of the ordinary engine indicator as a standard for results. Thus the only method practicable was to obtain the developed electrical horse-power of the unit and correct this by engine friction and generator losses as determined by subsidiary tests, these tests becoming practically of primary importance, as indicated by results of preliminary trials. The final decision was to make friction determinations by two methods, hereinafter designated and described as the electrical method and the continuous indicator method, the former to be considered decisive if checked up to within 10 per cent by the latter.

The following is a description of the conduct of the test proper and the subsidiary tests, classified as reported by the engineer in charge of each department of the test.

ENGINE TEST PROPER: ENGINE AND STEAM READINGS AND DETERMINATIONS

The engine designated as No. 8, being so situated as to permit unit isolation from the rest of the plant, was selected as representative of the complete installation. All steam and water mains and auxiliary lines in the unit were either entirely cut off from the rest of the house or separated by two valves and a bleeder or drip valve between. The unit as thus isolated consisted of seven boilers, the water ends of a boiler-feed pump and a circulating pump respectively, and the main engines.

Apparatus as required for the test was installed as follows: For weighing the total feed-water as delivered by the supply line, four tanks, mounted in pairs upon two 20-ton scales, with a capacity per pair of 28,000 lbs of water, were used. The delivery from the weighing tanks was to two reservoir tanks connected by equalizers, and then in turn to the boiler-feed pump. For weighing of drips, leakage, etc., small scales and tanks were erected as necessary. Peabody throttling calorimeters were connected to the main line, in close proximity to the throttle, for use in case of wet steam. All gages and thermometers were carefully calibrated and standardized to the satisfaction of both parties. For the purpose of correcting for changes of level of the water in the boilers, scales graduated to tenths of an inch were placed close to each gage glass, and a temporary walkway erected to facilitate readings. Floats indicated the level of the reservoir tanks, this level being maintained a constant. To eliminate the use of the calorimeters, the steam supply was maintained at a constant low degree of superheat, one boiler containing superheater coils and this operated as desired. Vacuum was maintained at an average of 26 ins. mercury. Due allowance was made for all known leakage and drips. Readings were taken at 15-minute intervals, an hourly graphical log being maintained.

ELECTRICAL READINGS AND DETERMINATIONS

The load on the engine was measured electrically, by means of four balanced three-phase integrating wattmeters of the induction type, connected to current and potential transformers, located at the terminals of the alternator and connected as follows: Three current transformers, one in series with each of the three armature conductors, and two potential transformers, connected from phases 1 to 2 and 2 to 3, respectively.

As the potential transformers were designed for use under closely defined conditions, and could, therefore, be accurately standardized by the makers, their ratio, which is 100 to 1, was assumed to be correct. In the case of the current transformers, however, where the ratio is subject to change, due to changed secondary resistance, it was considered desirable to recheck the ratios, which was done as follows:

The generator was short circuited with a standard Kelvin ampere balance in series with the current transformer in phase 1, while a portable ammeter was substituted for the regular switchboard ammeter, in the secondary side, thereby securing accurate measurement of the secondary current without altering the secondary resistance appreciably, while all other instruments having a current winding, which were to be used for the test, were included in the circuit. The generator was then run at full speed, and the excitation adjusted to cause full-load current (263 amps.) in the armature, which was found to be constant. During this period, twenty readings of primary and secondary current were taken simultaneously, by means of telephone communication between the readers of the Kelvin balance and secondary ammeter. From these corrected readings the true ratio of transformation was calculated. It can be seen that this method of test, which is made under operating conditions, will correct for any error due to inductance in the secondary circuit, caused by running the current transformer leads in iron pipes, which could not be corrected for in the original manufacturer's ratio test. This test was repeated for phases 2 and 3 under similar conditions. The calibrating watts for the four balanced three-phase wattmeters were calculated from the corrected transformer ratios, and the meters calibrated and adjusted by comparison with Weston standard wattmeters, the calibration of which will be described later.

The meters were connected as follows: One in the secondary of the current transformers in phases 1 and 3 respectively, and two in that of phase 2, the object of this method being to show by the readings of the meters in the three phases that the load was balanced, while the object of the two meters in a single-phase was to furnish a continual check on the calibration of the meters. It was found that all meters agreed within their limit of precision, and results were therefore calculated from the average of the readings of the four meters, which was taken to be the true output of the generator in kw-hours.

FRICTION DETERMINATION AND ELECTRICAL LOSSES (ELECTRICAL METHOD)

The combined losses in the unit were ascertained by driving the generator as a synchronous motor with the engine trailing, and measuring the watts input, which it can be seen would consist of combined friction and windage, I^2R losses and iron losses. As this input was too small to be measured accurately by means of the four lead meters, a special meter with its standardized current transformer was used. The unit could not be motorized for periods longer than 5 minutes, because of the difficulty in lubricating the cylinders, which was not long enough to give a dial reading on the meter; so the meter during the short run was read by counting the revolutions of the disc, timing same with two chronograph watches reading to tenths of a second, and the mean kilowatt figured by the usual calibrating formula. During this period, the field current was held at that value corresponding to full-load excitation, in order to make the iron losses the same as at full load, and was read on a Weston standard portable ammeter. The armature volts and amperes were also read at 10-second intervals, in order to obtain the power factor, which, due to the over-excitation of the field at such small load, was low, averaging for the several trials 18.5 per cent with a leading current. As the meter used for this test was calibrated at a power factor of 1.0, it was necessary to check it on low values, and readings were, therefore, taken with a leading current at ten points from 0.1 to 1.0, and a curve plotted, showing the error, which curve was used to correct all readings taken on the friction trials. To this corrected input, as the armature current was below full-load value, must be added the difference between the I^2R losses at the observed value and that corresponding to full-load current. From the above, the output of the generator plus the input to the generator motorized, plus the difference between the I^2R loss at motor current and the same at full-load current, equals the total load on the engine in kilowatts.

CALIBRATION OF METERS USED DURING TEST

The Kelvin ampere balance used for the ratio tests was compared with a potentiometer and standard resistance. The ammeter for the secondary current was compared with the current dynamometer, standardized by means of potentiometer and standard resistance. The current transformer for the friction trials was checked by comparison with a Kelvin ampere balance. The standard indicating wattmeters, used for calibrating integrating wattmeters, checked by comparison with the Weston laboratory standard voltmeter and potentiometer and standard resistance. The Weston standard portable shunt and millivoltmeter was checked by comparison with potentiometer and standard resistance. The work of calibrating the standards was performed by the Electrical Testing Laboratories, of New York, in all cases, and in addition, by comparison with the Interborough Rapid Transit Company's own standards whenever possible, in all of which cases the same agreed within the limits of precision of the instruments tested.

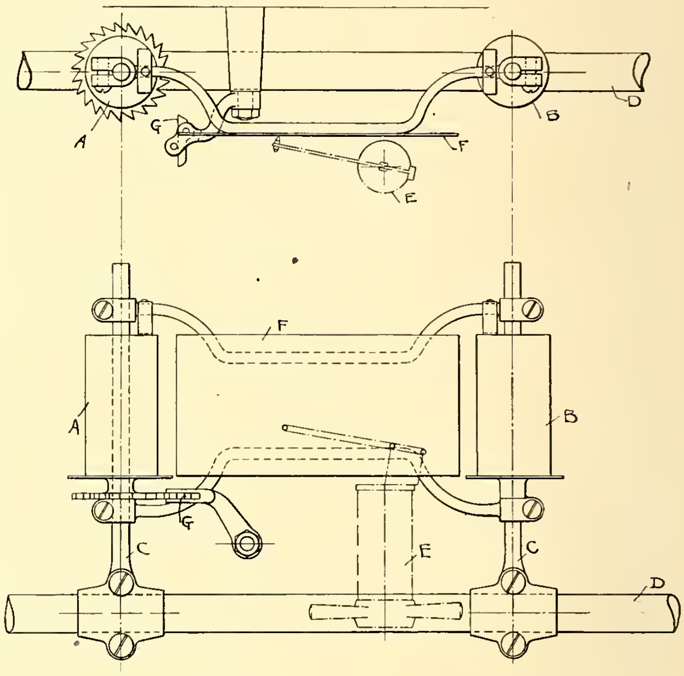
FRICTION DETERMINATION BY CONTINUOUS INDICATOR METHOD

For this purpose a continuous indicator was designed by W. L. Seabrooke, of the Interborough, which instrument solved the problem of indicator application to the engine.

The device consists of two drums "A" and "B," turning freely on spindles "C"-"C," mounted on the mandrel "D," which has a reciprocating movement in front of the indicator "E," the latter being of regular standard design, except for the removal of the drum. A strip of paper, winding on "A" from "B," passes over the plate "F," thus presenting a flat recording surface. As the back pressure line is traced, the ratchet "G" contacts with the toothed wheel under the drum "A," causing it to rotate a fixed distance. This movement defines the distance between successive cards, and can take place at any point of the stroke desired. As the back pressure line is usually straight no error is introduced, and the cards present the same appearance as if taken singly. The operation is automatic, and records a card for each revolution, to the extent of the paper supplied by the drum "B." Using this device, two sets of indicator cards were taken on the engine running empty; one for a period of 2 minutes with an exciter current of 165 amps., and the other for a period of 1½ minutes without the exciter.

LEAKAGE TEST

A leakage test of boilers, and boiler-feed and steam lines to the engine throttle were made 36 hours subsequent to the official engine trial, said test being of 24 hours' duration. In connection therewith, water was weighed and fed to the boilers



CONTINUOUS INDICATOR DIAGRAM DEVICE

by way of the reservoir tanks, as in the engine test. Due allowance was made for all known leakage and drips, and correction made for change in boiler level.

RESULTS OF FRICTION TRIALS (ELECTRICAL METHOD)

1. Volts armature by switchboard meter, 10,510 volts.
2. Amperes armature by switchboard meter, 119. 6 amps.
3. Amperes field by Weston standard, 202. amps.
4. Kilovolt amperes armature 3 × (1) × (2), 2170 k. v. a.
5. Power factor, (6) ÷ (4), 18.55 per cent.
6. Kw input, $\frac{427.4}{106.1} \times 100$, 402.5 kw.
7. I^2R on test $(119.6)^2 \times (11)$, 4.12 kw.
8. I^2R at full load $(263)^2 \times (11)$, 18.92 kw.
9. Difference between (7) + (8), 14.8 kw.
10. Total losses (6) +. (9), 417.3 kw.
11. Resistance of armature at 30 degs. C, 2877 ohms.

The value 417.3 kw is therefore added to all full load output readings, to obtain total load on the engine.

RESULTS OF FRICTION TRIALS (CONTINUOUS INDICATOR METHOD)

1. With exciter current, engine empty, 580.78 ihp.
2. Without exciter current, engine empty, 432.7 ihp.

RESULTS OF ENGINE TRIAL

A summary of the test results, with averages, is as follows: Test, Dec. 6. 1905.

Duration, 15 hours.
Preliminary operation on load, 2 hours
Load (switchboard reading), 5079.2 kw.
Friction and electrical losses, 417.3 kw.
Total load, 5496.5 kw.
I. H. P., 7365.3.
R. P. M., 75.02.
Steam pressure, 175.18 lbs. (gage.)
R. H. receiver pressure, 19.1 lbs. (gage.)
L. H. receiver pressure, 19.27 lbs. (gage.)
Vacuum, 26.02 ins.
Barometer, 30.5 ins.
Temperature injection water, 42.36 degs. F.
Temperatur R. H. discharge, 74.05 degs. F.
Temperature L. H. discharge, 77.38 degs. F.
Water per hour, 89,906 lbs.
Weighed leakage per hour, 512 lbs.
Leakage per hour (leakage test), 1470 lbs.
Boiler level correction, per hour, 60 lbs. (high.)
Net water per hour, 87,864 lbs.
Correction for superheat, 28 per cent.
Equivalent dry steam per hour, 88,110 lbs.
Dry steam per kw-hour (switchboard), 17.34.
Dry steam per ihp per hour (engine), 11.96.

The tests were under the supervision of Frank N. Waterman, who acted as referee. The following represented their several companies: Interborough Rapid Transit Company—H. G. Stott, superintendent motive power; J. Van Vleck, mechanical engineer; H. W. Butler, principal assistant engineer; Thomas Allsop, mechanical engineer, Fifty-Ninth Street power station; C. W. Ricker, electrical superintendent; G. F. Chellis, instrument man; W. L. Seabrooke and W. S. Finlay, assistant engineers.

Allis-Chalmers Company—A. M. Mattice, chief engineer; Samuel Moore, district superintendent of erection; T. T. Hubbard, engineer test; J. E. Lord, sales representative; C. A. Hoppen and C. J. Larsen, construction department; A. F. Rolf and F. Buch, electrical representatives.

EAST BOSTON TUNNEL FIGURES

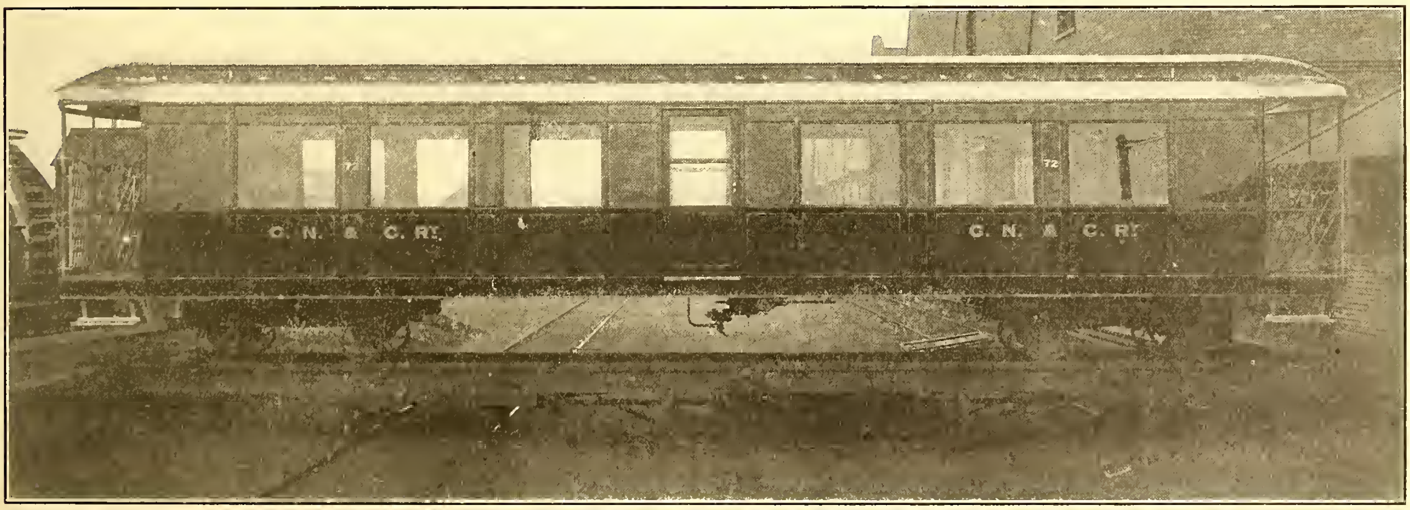
The Boston Elevated Railway has turned into the treasury of the city of Boston $83,004.44, representing the 1-cent toll which the company collects from those using the East Boston tunnel. The company has also paid to the city as rental $35,000, which represents 3/8 of 1 per cent of the gross income of the company for the nine months ended Sept. 30. The gross income of the company for the nine months was $9,332,800.

STEEL CARS FOR THE GREAT NORTHERN & CITY RAILWAY

The practice of using steel cars for subway work is as general in England as in the United States. An account was published in the Dec. 2 issue of the new steel cars recently built by the Brush Electrical Engineering Company for the Great Northern, Piccadilly & Brompton Railway, one of the Yerkes lines in London. The accompanying engravings show views of some cars recently completed by the same manufacturers for the Great Northern & City Railway, another of the underground lines in London.

INTERIOR OF GREAT NORTHERN & CITY CAR

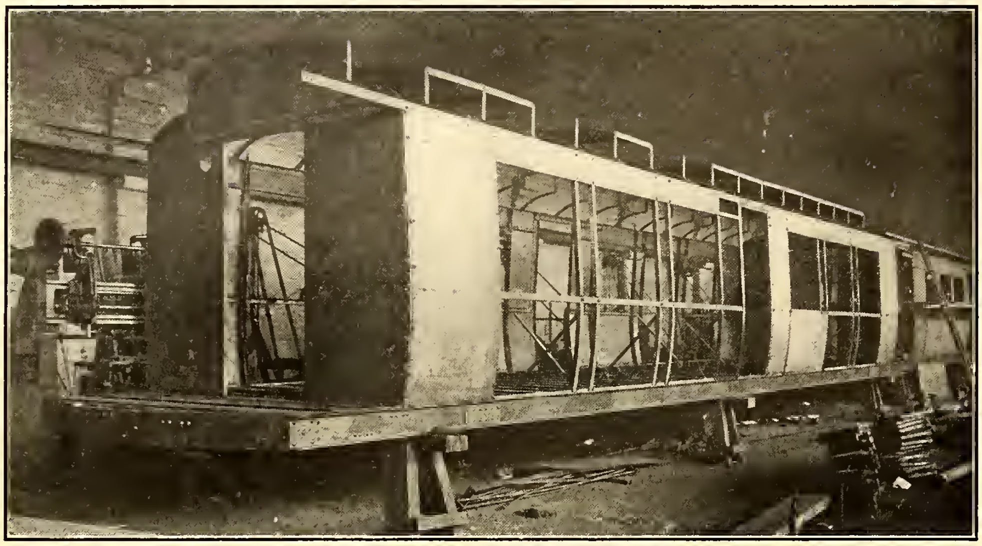
In the eighteen cars now under construction for this railway, the under-frame, corner posts, intermediate pillars, carlines and outside panels are entirely of steel. The floor is of sheet-steel covered with a 1-in. layer of lito-silo, a non-inflammable composition, chiefly consisting of whiting, cork-dust, iron oxide and cement. This material has the same appearance and resiliency of linoleum, but is not affected by heat or cold, and has a high coefficient of friction, so that passengers can easily keep on their feet when the car is moving. The seat-legs are of malleable iron. The inside paneling is of aluminum sheets 1-16-in. thick, running as high as the roof-rail. There is no inside finish on the roof, the car lines being made of channel steel. The seats are of the spring type, built upon an iron frame and covered with rattan.



BODY OF GREAT NORTHERN & CITY STEEL CAR

The electric light wiring is encased in highly polished brass tubes, attached to the car-lines at the base of the clerestory roof on either side of the car. The brass parcel-racks, door-handles and hand-rents on the seats have a distinctly ornamental effect. An important feature in the design is the absence of hanging straps for standing passengers. The small quantity of wood used in the car, chiefly for ornamental purposes, could be dispensed with if required, but it does not affect the absolute safety of the car from fire.

There is nothing in the appearance of the car to indicate that it is made of metal, all rivets, etc., being concealed by the ornamental features. The exterior is painted the color of teak, picked out with Indian red and gold. Inside all ornamental details are of teak shown in the natural grain. The roof is painted white and the sides cream. The floor is the color of terra-cotta.



STEEL CAR FOR GREAT NORTHERN & CITY. CAR UNDER CONSTRUCTION

The number of passengers that can be seated is sixty-four; but each passenger has more room and the aisles are wider than in a wooden car, as although the overall width is only 9 ft. 4 ins., the same as in the cars now running on the Great Northern & City Railway, the sides are less than half as thick, so that the passengers get the benefit of the extra space left inside.

To keep the weight of the vehicle as low as possible, the full depth of the side has been utilized as a girder, thus securing great stiffness with the minimum material. As a high factor of safety is essential in rolling-stock, no part of the structure is stressed higher than 9000 lbs. per sq. in. of section.

The corner and door pillars are of angle-steel section, and the intermediate pillars of channel steel, shaped to the proper curvature of the side and flanged at the ends, to suit the top and bottom member of the girder, to which they are well riveted. In addition to the top and bottom members, which are of angle and channel steel respectively, and extend the whole length of the car, there are two intermediate members extending between the corner and side-door pillars in one piece, notched out to receive the intermediate pillars and riveted thereto. These members are arranged to receive the window frames, the upper rail being of angle section, and the lower, or waist, rail of channel section. The side body panels are ⅛ in. thick, those adjacent to the corner and door pillars being in one piece from top to bottom. The panels are well riveted to all the side members, the rivets being arranged in the corners to form a strong gusset. To stiffen the sides against the lateral stresses, diagonal braces of T-section steel are arranged in the backs of the double seats, riveted to the waist rail of the sides and to the longitudinals of the underframe.

The load is transmitted to the side girders by means of longitudinals of girder section weighing 5.4 lbs. per foot, which, in turn, are supported on cross bearers of similar section weighing 11 lbs. per foot. The cross bearers are secured to the tension member of the side girder by angle-iron knees, suitably riveted. The main bolsters are each designed to take the combined stresses due to the weight of car and of the passengers, and also the stresses set up by buffing and hauling. They are built up of two channels weighing 32 lbs. per foot, with the side brace-plates riveted thereto, and further strengthened at the center by steel forgings which are utilized to take the king-pin for the trucks and also for the draw gear. The side bearings on the bolsters are pressed from ⅜-in. steel plate and are fitted with ½-in. renewable wearing faces. The center bearings are arranged so that they may be lubricated from the interior of the car.

The underframe is braced against diagonal stresses by means of a steel floor plate 3-32 in. thick, riveted to the upper flanges of the member. This plate is strengthened by transverse flanged troughs ⅝ in. high and made from No. 16 S. W. G. sheet steel, the flanges serving to prevent the lito-silo floor covering from cracking or rising from the floor plate. The draw gear is the Great Northern & City standard type, modified to suit the special features of the cars, the whole of the stresses being transmitted to the main bolster through a cast-steel girder section bar and the king-pin. The principal dimensions are as follows.

Length over body	41 ft.
Length over platforms	49 ft. 6 ins.
Width over pillars	9 ft. 2⅞ ins.
Extreme width	9 ft. 4 ins.
Height from floor to roof	8 ft. 5 ins.
Height from rail to top	12 ft. 4½ ins.
Gage	4 ft. 8½ ins.
Wheel base	6 ft. 1 in.
Truck centers	34 ft. 6 ins.
Diameter of wheels	3 ft.
Seating capacity	64
Weight of car-body	23,912 lbs.
Weight complete with trucks, but without electrical equipment	39,368 lbs.

The trucks are of the standard Brush type as at present in use on this railway.

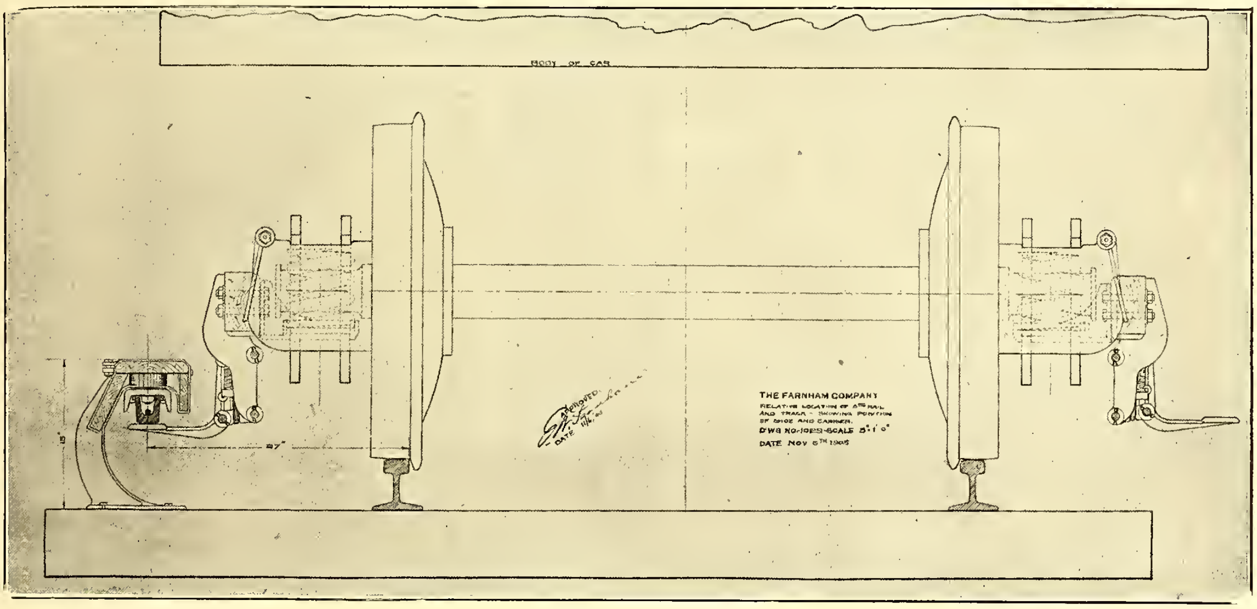
NEW PASSENGER CARS FOR THE CHICAGO & MILWAUKEE ELECTRIC RAILWAY

The new cars for the Chicago & Milwaukee Electric Railway Company will be built by the Jewett Car Company. The cars, of which there are to be ten, will be constructed after designs worked out in the offices of the railway company. They are to be much larger than any closed car now in use on the system, measuring 52 ft. over all and seating fifty-six passengers. The interior will be divided into two compartments, a main passenger compartment seating forty people and a smoking room containing seats for sixteen passengers. The arrangements for the hot-water heater, which will be placed in the smoking compartment, are such as to permit its removal during those seasons of the year when it is not needed, a double seat being inserted in its place.

All of the longitudinal sills of the bottom framing will be reinforced by either I-beams or channel beams. The type M control will be employed, and the trucks will be fitted with four General Electric No. 73 motors.

THE FARNHAM PROTECTED THIRD-RAIL SYSTEM

The inverted third rail being installed upon the Philadelphia & Western Railroad, referred to on page 1088 of the STREET RAILWAY JOURNAL for Dec. 23, 1905, is what is known as the Farnham protected, inverted third rail, and is such a radical departure from the usual type of third rail that the operation of the road will no doubt be watched with unusual interest. The rail is the invention of E. W. Farnham, of the Farnham Company, electrical engineers and railroad contractors, Chicago, and its general designs may be understood from the illustration. The upright support brackets of malleable iron are securely fastened to the ends of the ties by lag screws, at intervals of 8 ft. The rail, of "U" shape, is provided with flanges at its two sides, by which it is suspended from the support brackets in a manner that effectively insulates it from the support brackets and at the same time permits the rail to move longitudinally, thus providing for the usual expansion and contraction. Sufficient allowance is made in the hanger for the rail to take up all vibration and jar between the iron hanger and steel rail, caused by the passing of trains upon the track rails. The method followed is claimed to be superior to that of supporting the rail in or on any insulation of a crystalline nature under tension, as it avoids all tendency to direct vibration, jarring or pounding between the insulating material and the steel rail.



SECTION OF TRACK AND AXLE, SHOWING THIRD-RAIL SYSTEM

Efforts to avoid these conditions and provide a method of suspension having stability and durability resulted in the form now being constructed, and also in the production of an insulator consisting of a fibrous vegetable compound, said to be of great mechanical strength, fire-proof and of high dielectric strength. A compressional, rather than a tensional strain is exerted upon the insulator by the method of suspension of the rail. An insulating bushing is fitted into a cup cavity in the top of the support bracket. A steel bolt passing through the steel washer at the top of the bushing, thence through the bushing and the insulator, engages the rail hanger by a screw thread, which, when screwed up tight, suspends the rail in the hanger. The rail, hanger and bracket are thus thoroughly insulated from the support bracket. As a further protection, after the bolt has been screwed up tight, the cup in the top of the bracket is poured full of the insulating compound in liquid form, which eliminates all danger of a foreign substance causing a ground or short circuit, and at the same time prevents the bolt working loose. The "U" shape form of the rail permits the carrying of copper reinforcing wires in the groove, for the purpose of providing additional carrying capacity. When employed, such reinforcing wires are laid bare of insulation directly within the groove, and low-resistance contacts are made by a compound plastic bond at all rail-joints, thus bonding the reinforcing wire and the rail-joints at the same time.

The rail itself is of very soft steel, and is made especially for this section for the purpose of providing a section of very high conductivity. Protection is given the rail by three planks, each of sufficient length to extend between two of the upright support brackets, and fitting into recesses or pockets in the brackets. The top plank retains the other two in position, and a casting called the cover lock, which covers the joint between two adjacent top planks, locks all of the protecting planks in position. The cover is so arranged that snow instead of piling up underneath, will be blown through, leaving the space under the rail clear and unobstructed. The boards are all dipped in an insulating compound of a fire-proof nature before being put in place.

A special type of shoe-carrier and collector is used in connection with this underrunning contact rail, which gives a parallel motion at all times, and consequently a perfect contact with the under surface of the rail, and an even wear upon both the rail and the shoe.

During some days, since the beginning of the holiday shopping season, the New York Subway has carried from 510,000 to 514,000 passengers, while the average for many days past has been something over 500,000 daily. Naturally enough, the underground has had some effect upon the elevated roads, as in the case of Monday, Dec. 11, for instance, when the elevated traffic recorded 730,000 passengers, a decrease of 27,000 from the same date in 1904. At the same time, the increase for that day over Dec. 11, 1904, in subway travel was 302,000 passengers, showing that the underground is not only taking the overhead, but the surface companies as well. However, the fact should be remembered that several thousand people now live along the line of the subway, or near it, that did not live there a year ago. The Interborough Company is now carrying an average of 1,250,000 persons daily, compared with about 1,060,000 a year ago at this time. Traffic figures for the early part of December, so the records show, generally hold good as an average until May, which means that the monthly gross earnings will show an increase of over $250,000.

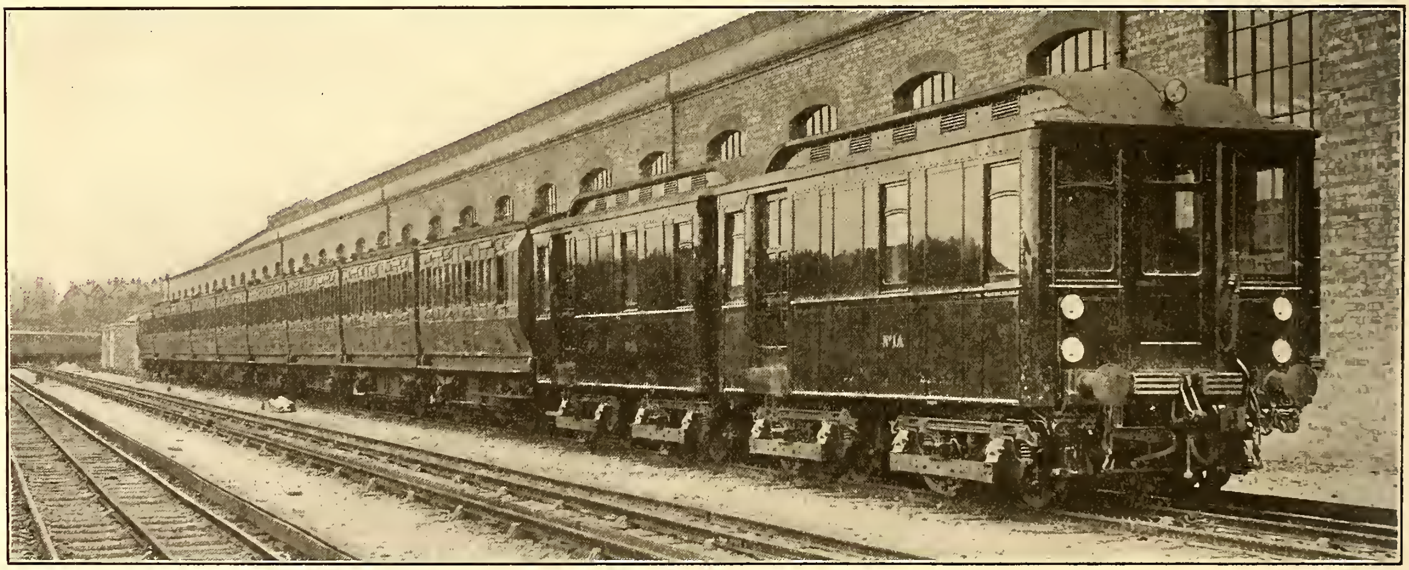
ELECTRIC LOCOMOTIVES FOR LONDON & NORTHWESTERN CARS IN LONDON

From frequent articles in this paper and from notes in the monthly "London Letter," the readers of this journal are undoubtedly familiar with the fact that the electrification of the Metropolitan District Railway Company, which is a portion of the old Underground Railway system of London, has now been practically completed. The steam-drawn trains, composed of coaches with the usual first, second and third-class compartments, have been withdrawn and long, center-aisle cars equipped with the multiple-unit system have replaced them. As is also well known, a portion of the underground railway system has long been used also by the trains of the London & Northwestern Railway Company, one of the British trunk lines. The trains of this company start from the Broad Street station in the city and run on an open railway around the north of London to Willesden Junction, where they cross the main line of the London & Northwestern Railway Company and run to Earl's Court before they actually enter the trunk system.

DISTRICT RAILWAY LOCOMOTIVE IN TWO UNITS

This portion of the London & Northwestern Railway Company's track has not been equipped electrically, and as the cars used on this line were modern and lighted by electricity, it was decided to be unnecessary to change the rolling stock. At the same time, the managers of the Metropolitan District Railway Company naturally did not wish any steam-drawn trains in their tunnel after their own system of electrification was complete. It was decided, therefore, that electric locomotives should be used to draw the London & Northwestern trains through the tunnel. These locomotives are attached to the trains at Earl's Court station and draw them the remaining portion of their journey from this station to the Mansion House station. Views of a locomotive unit and of a complete train of cars are presented herewith.

The locomotive bodies and trucks were built by the Amalgamated Railway Carriage & Wagon Company, of Birmingham. The electrical equipment was furnished by the British Thomson-Houston Company, of Rugby, England, and consists of B. T. H. type GE-69 motors, similar to those used on the other underground trains in London. The Sprague-Thomson-Houston multiple-unit system of train control is used. Each of the two locomotives attached to each train is supplied with four motors, and each motor is of 200 hp, so that the total per locomotive is 800 hp. The combined weight of the two locomotives shown in the illustration is about fifty-six tons, or seven tons on each driving axle. The weight of the London & Northwestern train, with load, is approximately one hundred and forty tons.



TRAIN OF LONDON & NORTHWESTERN CARS, WITH DISTRICT RAILWAY LOCOMOTIVES

Before the Circuit Court of Monroe, Mich., the Toledo, Ann Arbor & Detroit Railway recently won an interesting decision against the Michigan & Ohio Railway Company. The first-mentioned company has a road well under way between Toledo and Ann Arbor. Some time ago it attempted to condemn right of way through the property of one Perry Closer, of Petersburg. It is claimed that Closer and associates organized the Michigan & Ohio Company with the avowed purpose of building a line from Petersburg to Dundee, a distance of 7 miles, but that in reality they aimed simply to take advantage of an old Michigan law which prevents one road from condemning the right of way of another road until it had been unused for five years. The court held that the complainant company was conceived in fraud, that it had no intention of building a road and that it existed simply for the purpose of holding up the other company, whose line had been surveyed and mapped out through the property two years before the complainant organized a rival company.

A 500-B.HP. GAS ENGINE

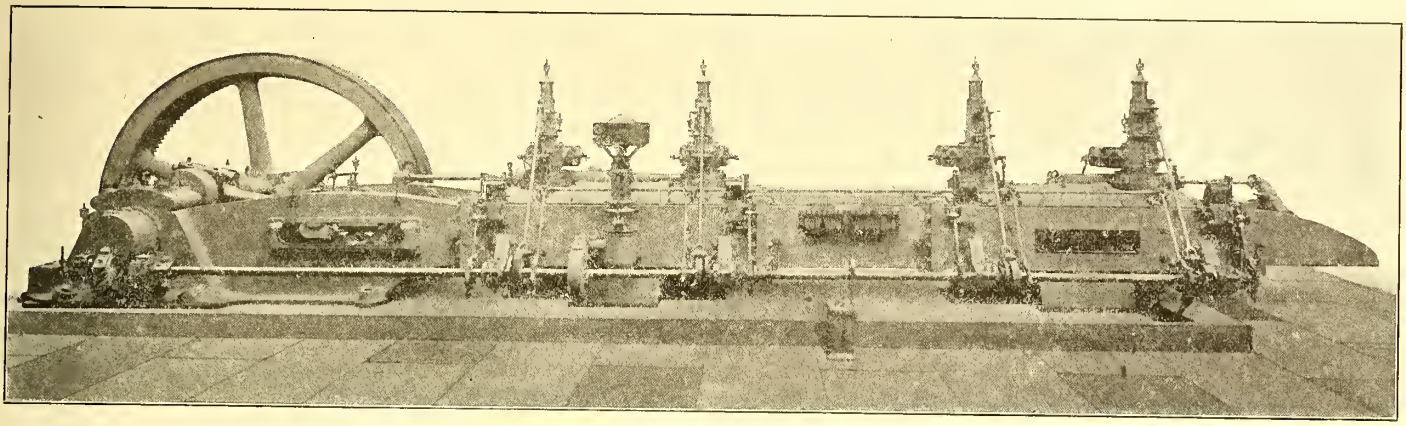
The progress that is being made by the gas engine is well exemplified in the type shown in the accompanying illustrations of an engine built by Richardsons, Westgarth & Company, Ltd., of Middlesbrough, Eng., who manufacture the well-known Cockerill type gas engine, under license from the Societe Anonyme John Cockerill, Seraing, Belgium. This engine has two double-acting cylinders, which are 23⅝ ins. in diameter by 31½-in. stroke, placed tandem, and is now driving one of Brown, Boveri & Company's continuous-current generators, direct coupled to the end of the crankshaft and running at 125 r. p. m.

The engine was originally built for the electric station of the builders, but as soon as it was set to work it was purchased by the Cargo Fleet Iron Company, Ltd., of Middlesbrough, at whose works it is now installed, and where it is driven by ordinary blast furnace gas, which is cleaned by a Theisen rotary gas cleaner. This apparatus is also manufactured by the engine builders, and has proved to be entirely satisfactory in operation, as it cleans the gas so that it does not contain more than .02 grammes of dust per cubic meter. As gas engines run very well even with gas containing up to .1 gramme per cubic meter, the use of this apparatus eliminates all the trouble experienced in gas engines due to the presence of dust, etc.

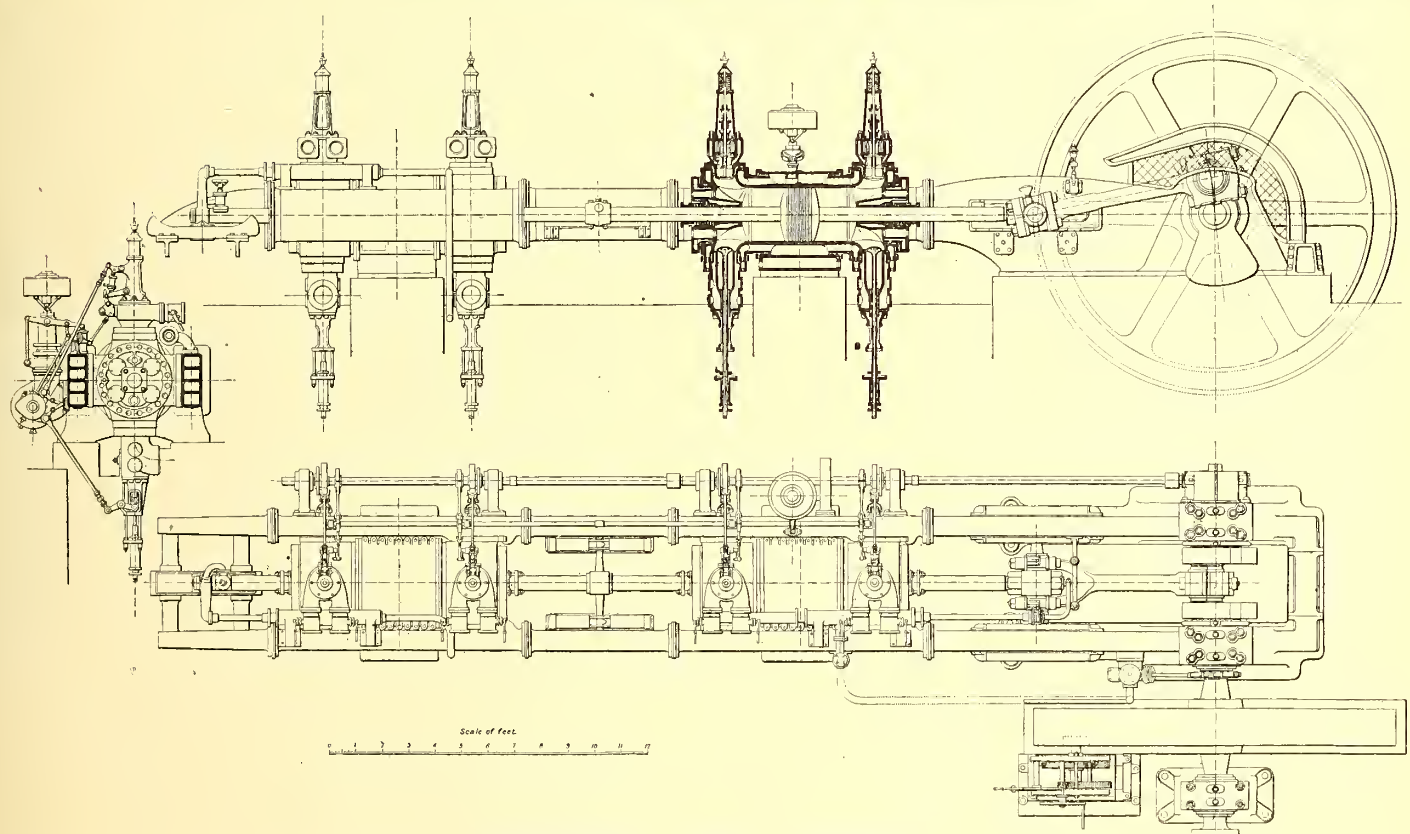
The engine works on the Otto cycle, and as it has double-acting cylinders, it receives one power impulse every stroke—that is, two impulses per revolution, like a steam engine. As will be seen from the illustrations, the gas and air valves are placed on top of the cylinders, thus making them most accessible. The exhaust valves are placed below, and one set of cams on the side shaft controls each complete set of valves, thus reducing the working parts to a minimum and making them very accessible. The cylinders are fitted with loose covers at each end to facilitate overhauling the valves and to enable the pistons to be drawn and examined very quickly.

In the arrangement of the longitudinal side frames carrying the cylinders, special attention has been given to allow for expansion and contraction to avoid undue strain being set up in the cylinders. This is secured by carrying the side frames continuously from the crankshaft to the end of the engine, the gas cylinders being secured to these side frames at one end only, and so arranged that they can be removed bodily without disturbing any other heavy part.

The engine is controlled by a special governor regulating



SIDE VIEW OF 500-B.HP GAS ENGINE



500-B.HP TANDEM DOUBLE-ACTING ENGINE

the amount of gas admitted to the cylinders; a constant compression is also maintained, independent of the load on the engine, to balance the inertia of the reciprocating parts, which insures steady running with a moderately heavy fly-wheel. Many of these engines are running in parallel with other steam and gas-driven engines driving alternators. The speed variation from normal to light load does not exceed 7½ per cent, and arrangements are made so that the speed of the engine can be altered 5 per cent while running.

In designing this engine, great care has been taken to insure efficient cooling; the cylinders with their covers and the pistons, piston rods, and exhaust valves with their chambers, also the main bearing bushes, are water cooled. A special pump, driven by eccentric from the crankshaft, circulates the water through the pistons and piston rods at a pressure of about 40 lbs. The cooling water for the pistons passes through the center of the piston rods, and is taken away at the back of the engine through the non-return valve shown.

The piston rods are made of forged ingot steel, having double cast-iron slides lined with best quality white metal on the working faces. The connecting rod is of the marine type, made of best forged ingot steel, having very large adjustable bearings at both ends, and these are lined with best quality white metal. The crankshaft is a built-up shaft, the body and pins being of forged ingot steel, and the webs of cast steel with balance weights cast thereon. This shaft is carried in two large main bearings, having separate cast-iron bushes lined with white metal. An outer bearing is also provided outside the fly-wheel next to the generator.

This engine is fitted with an improved Bosch magneto ignition, and in all subsequent engines two sets of this gear will be provided for each explosion end of each cylinder to insure certain firing and quick combustion of the gas mixture. For starting the engine, compressed air is used, drawn from a suitable reservoir.

These engines are specially designed for using ordinary blast furnace gas, in which case the compression pressure is kept high, which insures very quick combustion. This is a very important point, especially when the engine is running on light loads with corresponding weak explosive mixtures. By reducing the compression, richer gases can be used without danger of pre-ignition. The consumption of gas depends, of course, upon its calorific power. Where ordinary blast furnace gas is used, this is about 95 cu. ft. per British horse-power per hour. For producer gas the consumption is about 65 cu. ft. per British horse-power per hour.

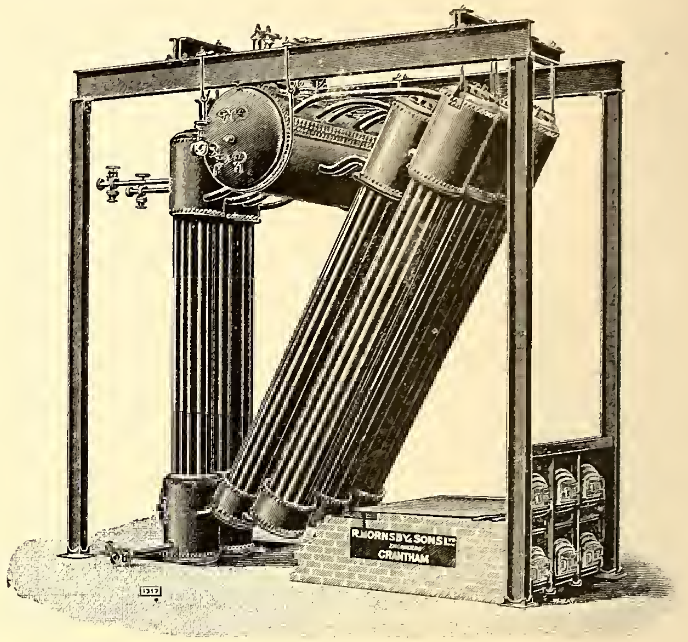
The makers of this engine have installed over 140,000 ihp in units up to 2200 ihp, and have now in hand two sets of 1200-B.HP. gas engines for rolling mill work, each engine having four double-acting cylinders, arranged in pairs, with two cranks and a heavy fly-wheel between them. These engines are to use Mond gas. They also have in hand several other large engines to use producer, coke oven and blast furnace gas.

A RECENT INTERURBAN MAP OF INDIANA, OHIO AND ILLINOIS

A map showing the extent to which the interurban railway has been developed in Indiana, Ohio, Illinois and Southern Michigan has been gotten out by General Manager Nicholl, of the Indiana Union Traction Company. All the interurban lines operating in the States named are shown in red upon a green background. The issuing of such a map is a rather unselfish move on the part of the Indiana Union Traction Company, as all the other lines shown will also be benefited. However, the increased travel induced over the company's own lines, by reason of the fact that connections with other lines are well shown, is a sufficient incentive for its publication.

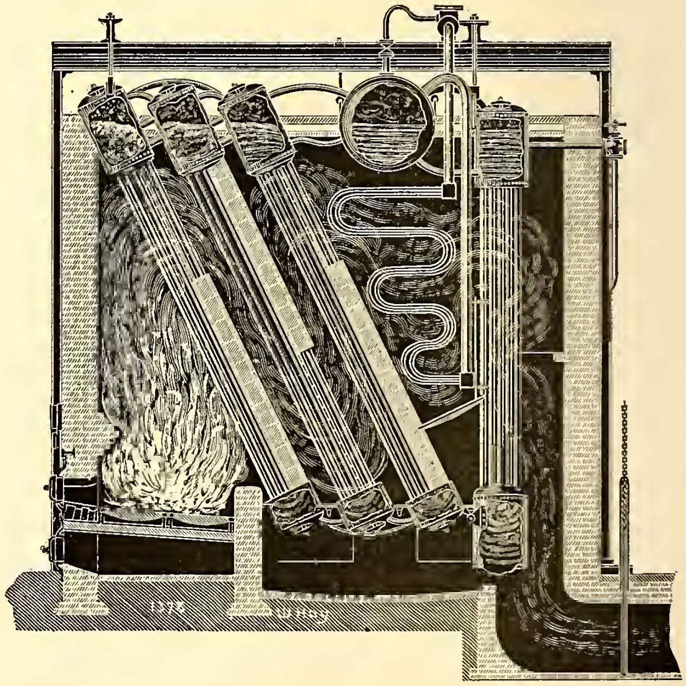
A NEW UPRIGHT BOILER

The accompanying cuts illustrate a new type of boiler now being put on the market by Richard Hornsby & Sons, Ltd., of Grantham, Eng., and which has been designed specially to



SIDE VIEW OF 390-HP WATER-TUBE BOILER, SHOWING GENERAL ARRANGEMENT, HANGING SECTION, COMBUSTION CHAMBER AND ECONOMIZING SECTION

take the place of the company's old horizontal type. This boiler can be made in very large sizes (up to an evaporative capacity of 100,000 lbs. per hour) without constructional difficulty, making it eminently suitable for the requirements of a

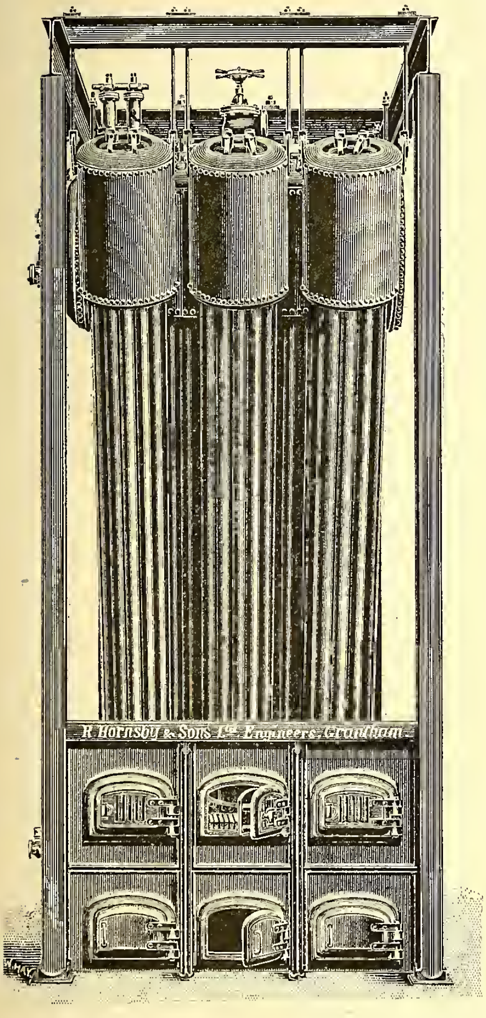


A SECTION OF UPRIGHT WATER-TUBE BOILER, SHOWING COURSE OF HOT-WATER GASES, COMBUSTION CHAMBER, SUPERHEATER AND GENERAL ACTION

modern central power station, with larget turbine units and and other gas engines.

The unique feature of this boiler lies in the fact that the whole boiler can be laid open for inspection by the removal of a small number of doors, for instance, in the 730-hp size, by the removal of only fourteen covers.

This upright water-tube boiler was designed to overcome the difficulties experienced with the old horizontal type, viz., the deposit of sediment in that part of the boiler which should be the most efficient (the lower rows of generating tubes), causing rapid loss by steaming power and efficiency, and making the use of the old type boiler for long periods without cleaning undesirable, unless exceptionally clean or distilled water was used. The feed-water being delivered to the back or least active part of the boiler, is relieved on its passage downward through the tubes of the bulk of its impurities, which are deposited in the form of liquid mud in the bottom back headers. What little sediment does pass into the generating tubes will not adhere to the walls of the tubes owing to their being set in a nearly vertical position, but peels off and drops to the bottom as soon as formed. Experience proved that the company's upright type, after being in constant work at full power for two years, shows less than 1-16 in. of scale on the tubes at any point, and even this small amount only in isolated patches, which, in their turn, fall to the bottom. This result is obtained without putting a scraper through the tubes at all, and without the necessity of drawing the water off, the tubes being simply brushed down from the top and the mud blown out through the bottom headers.



FRONT VIEW OF 390-HP UPRIGHT WATER-TUBE BOILER

It is claimed by the makers that absolute safety is secured, first, by the unexcelled circulation of the steam, which rises freely without encountering sharp bends or contracted connections, leaving the water always in contact with the hottest part of the tubes; by the absolute cleanliness of the interior of the tubes, which is maintained in the front sections immediately over the fire even after long periods of steaming; by making proper provision for easily and thoroughly inspecting the boiler at any time, at a minimum expenditure of time, money and trouble; by eliminating all flat surfaces and making every part of the boiler cylindrical and of great strength; by suspending the whole structure from the top, leaving it free to expand and contract independently of the brick-work setting and rigid frame work and foundation; by employing the best labor, materials and appliances.

The angle of inclination of the tubes, combined with their self-cleaning properties, insures the utilization of a very much greater proportion of the heat applied to them, thus conducing to great economy of fuel and thermal efficiency. Again, owing to the freedom from deposit in the generating sections, this water-tube boiler will maintain its maximum evaporative power and efficiency for long periods.

As a result of the design and the self-cleaning properties of the tubes, every foot of heating surface does its duty, and does it constantly, in practice, thus reducing the amount of heating surface required for a given evaporative duty. Owing to the angle of the tubes favoring the passage of the steam upward and inducing a strong circulation of steam and water, while the water is always in contact with the hottest part of the tubes, steam can be raised to working pressure at a very rapid rate, while in case of emergency, the Hornsby upright boiler can be forced to an almost unlimited extent.

The construction, in sections of about 3136 lbs. each, enables this boiler to be erected in the most inaccessible spots, while facilitating transport and saving freight, and the fact that it occupies small ground space makes it eminently suitable for central stations in large towns, where land is valuable.

In this boiler the steam mounts to the upper side of the tubes, and can thus rise unimpeded and without carrying over large bodies of water. In addition, on its passage from the front to the second row of headers, and so on to the steam drum, any moisture is gradually separated, and the steam at the stop valve is found to be exceptionally dry. The design and construction of the boiler reduce the possibility of priming to a minimum, and experience has shown that this boiler, even when forced to the extent of 20 per cent above its rated evaporative capacity, supplies steam containing less than 1.2 per cent of moisture, and at an ordinary average rate of working, the percentage of moisture in the steam is well below this figure. This point is recognized by engineers as of great importance, and for this reason it has been largely adopted by the more prominent manufacturers of turbines for their testing.

Where a superheater is required, it can be conveniently fitted to the upright boiler at low cost, or arranged alongside for separate firing, if considered preferable.

MAGANN STORAGE AIR BRAKES AGAIN AVAILABLE

The Magann Air Brake Company, Ltd., has been incorporated in Ontario, Canada, and has acquired all the assets, properties and patents of the old G. P. Magann Air Brake Company, of Detroit. The shareholders of the new company include well-known men in Toronto, of good financial standing and business reputation, who are able to provide ample capital for the development of the company's operations. Since starting business the new company has refitted the shops of the old company in Detroit, Mich., and materially increased the producing capacity. It has done a certain amount of business in the United States and Christchurch, New Zealand. Its main work, however, up to the present time has been in Canada, where it has a contract with the Toronto Railway Company for equipping some 330 of that company's cars with its storage air brake. This contract is now partially completed.

In addition to the Toronto Railway Company contract, some cars have been equipped for the Toronto & York Radial Company, which carries on a suburban business outside the Toronto city limits. The Magann Air Brake Company is at present negotiating for other contracts in different parts of Canada, and this year it will be in the field for further United States and other business. The system now being installed in Toronto is the same as that hitherto used by the old G. P. Magann Air Brake Company with one or two improvements.

The Western Ohio Railway and the Fort Wayne, Van Wert & Lima Traction Company have opened their new freight station in Lima. The two roads are preparing to operate four express and freight runs daily between Dayton and Fort Wayne.

TURBO-ALTERNATOR FOR GLASGOW

One of the most notable developments in dynamo machinery during the past few years has been their application to high-speed steam turbines. The conditions to be met call for a high degree of skill in design and considerable care in the manufacture. Though the electrical details of a high-speed machine necessarily demands close attention, the most serious problems are those of a mechanical nature; and this can be readily realized when it is mentioned that it is by no means uncommon to run the rotor of a 3000-kw turbo-unit at a speed of 1500 r. p. m. The accompanying engravings show the standard design of turbo-alternators adopted by Dick, Kerr & Company, of London. Among the most notable machines which this firm has completed or has under construction are the following:

Glasgow Corporation, two 3000-kw, three-phase, 6600 volts, 750 revolutions.

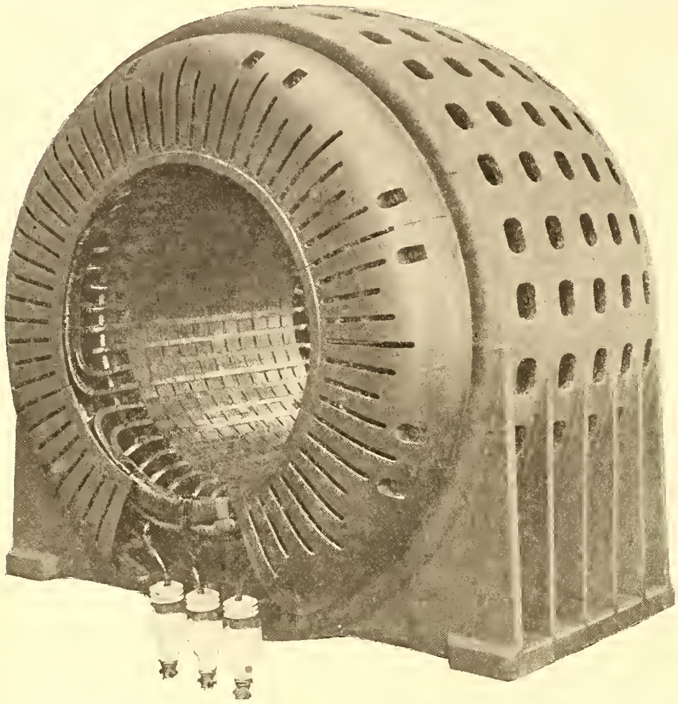
Bristol Corporation, two 1000-kw, three-phase, 6600 volts, 1500 revolutions.

Islington Borough Council, one 1500-kw, single-phase, 2500-2000 volts, 1500 revolutions.

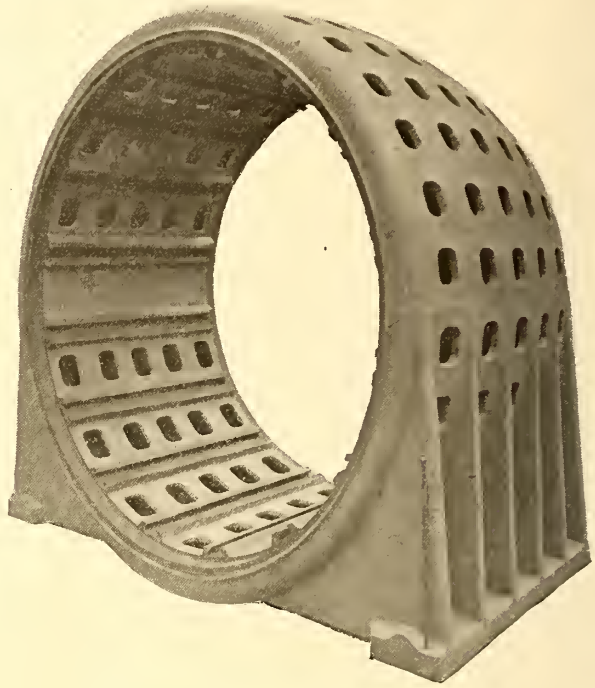
Metropolitan Electric Supply Company, one 3000-kw, three-phase, 11,000 volts, 1500 revolutions.

South Metropolitan Electric Supply Company, Ltd., one 1500-kw, two-phase, 3000 volts, 1500 revolutions.

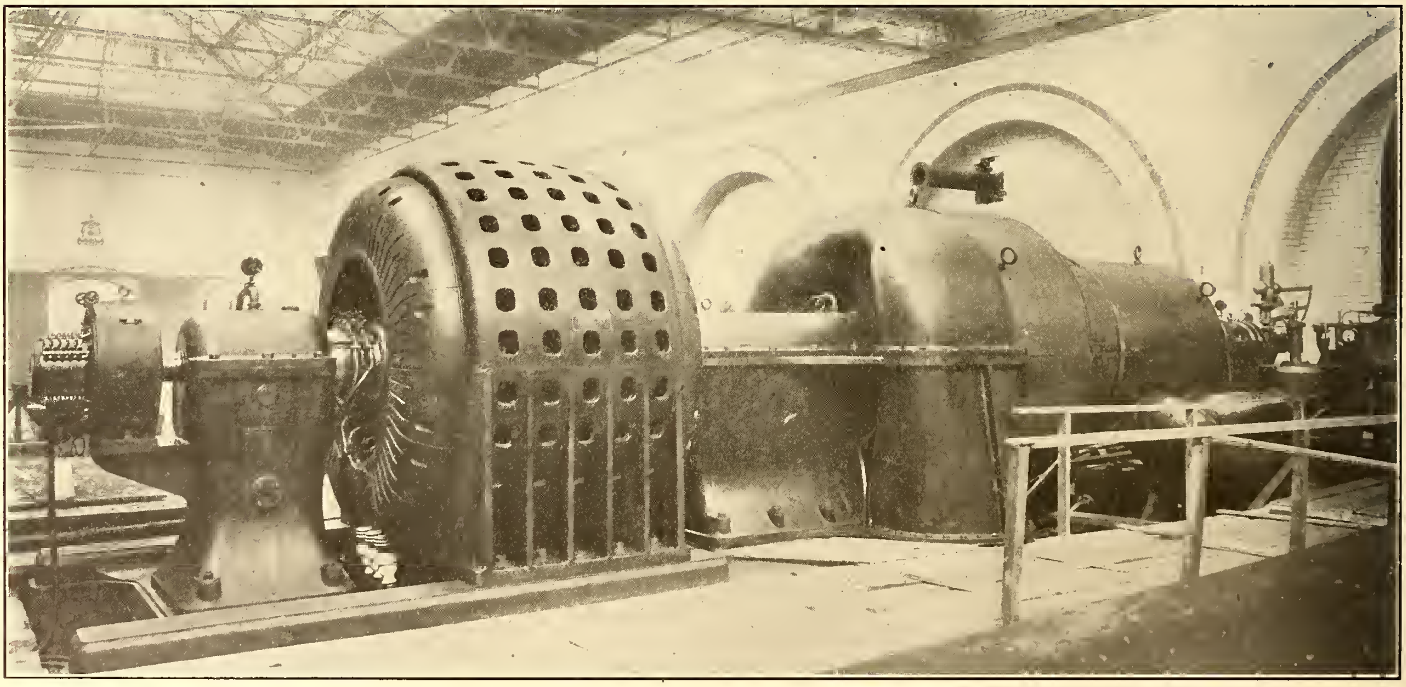
The frame of the stator is made of strong cast iron, and supports the stator laminations. The winding is embedded in slots and insulated by means of pure mica. Special ventilating ducts are provided in the frame, and stiffening fingers clamped on the outside of the laminations obviate danger of vibration. The feet of the alternator frame are bolted to a special sole



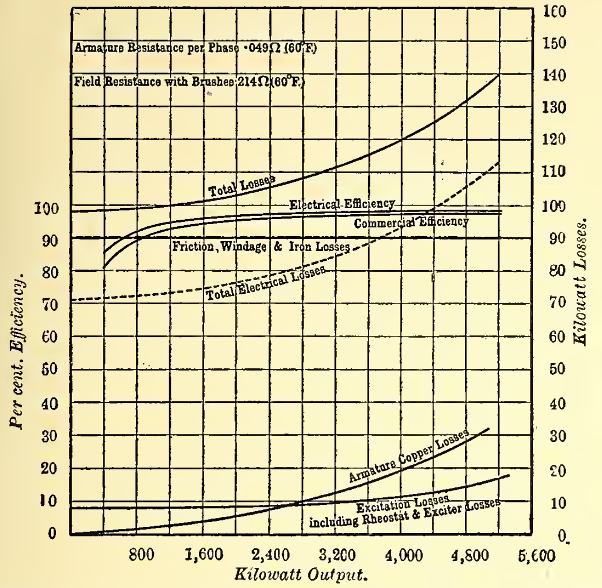
VIEW OF ALTERNATOR, SHOWING ARMATURE WINDINGS AND TERMINALS



FRAME OF GLASGOW ALTERNATOR

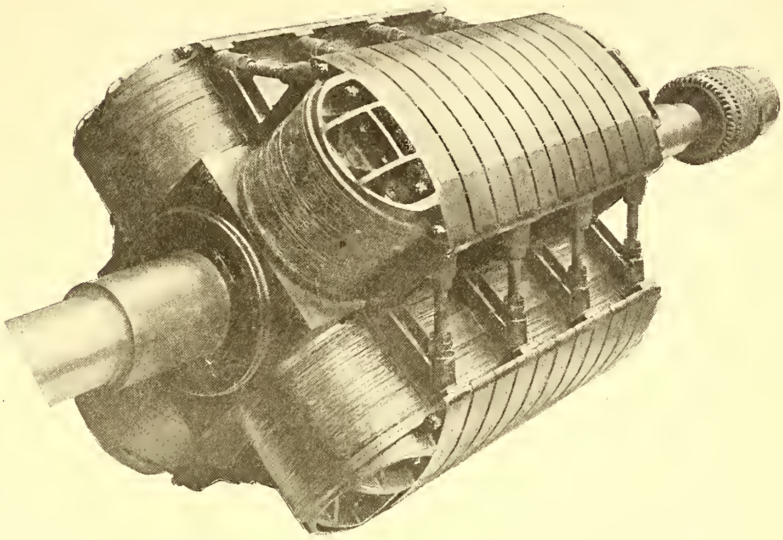


ONE OF THE 3000-KW TURBO-GENERATOR SETS INSTALLED FOR THE GLASGOW CORPORATION plate, and the bed plate is such that it is possible to slide the stator in a direction parallel to the shaft so as to uncover the rotor for easy inspection. Perforated shields protect the outside windings against accidental contact or mechanical injury, and are furnished with open spaces for ventilation. The outside of the high-tension windings is covered with sufficient insulation for the full voltage.



PERFORMANCE CURVES OF 3000-KW, FOUR-POLE GLASGOW TURBO-ALTERNATOR, OPERATING AT 6700 VOLTS, 25 CYCLES, 750 R. P. M.

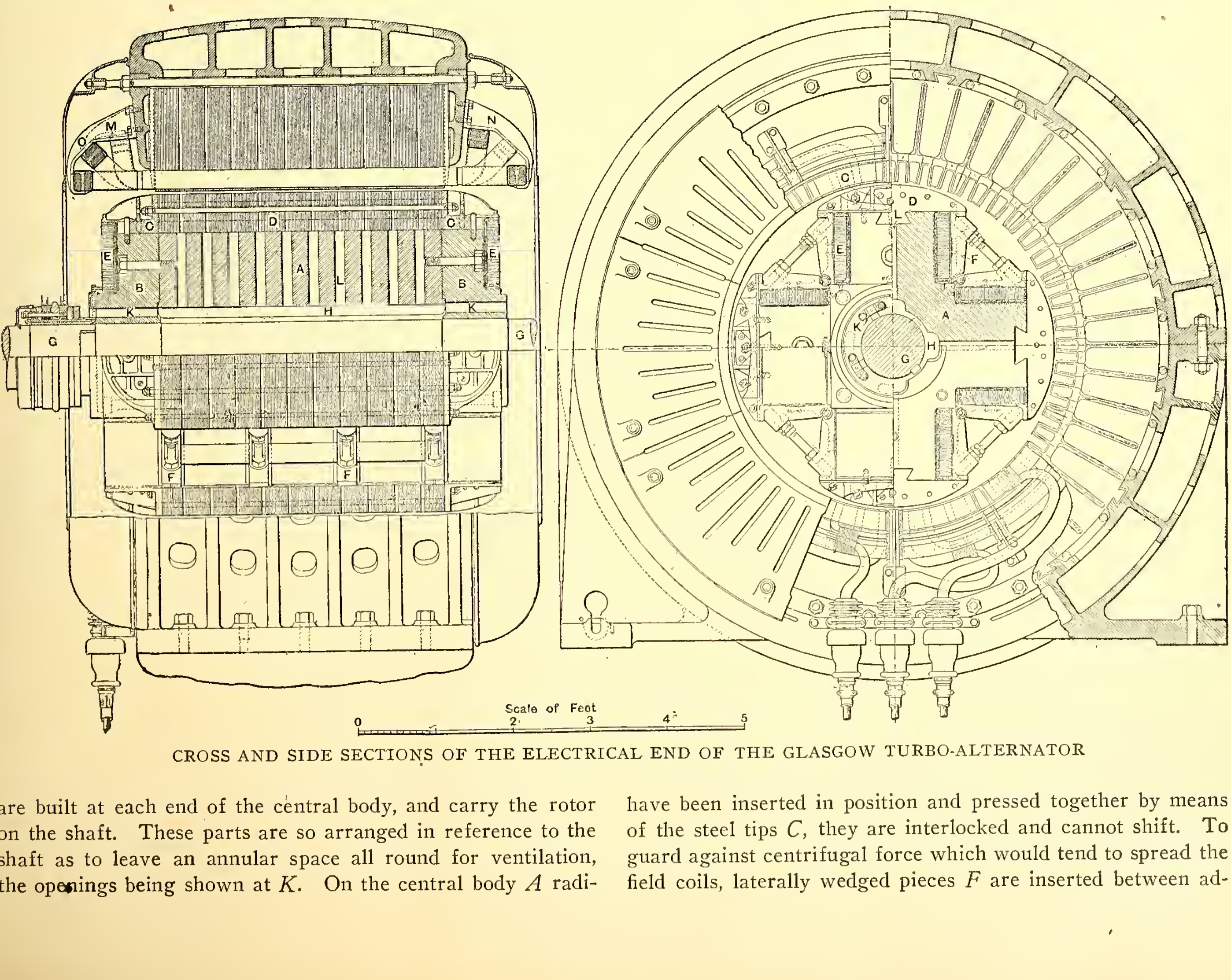
ally drilled passages L are provided, which correspond to air ducts in the laminated pole tips, these being in line with openings left in the stator iron. The pole tips are laminated and are dovetailed on the steel casting of the central body. Special end pieces, shown at C, also dovetailed on the steel casting, retain the laminated tips in position and at the same time act as checks against centrifugal force to keep the spools in posi-



VIEW SHOWING GENERAL ARRANGEMENT OF THE WINDING OF THE FOUR-POLE REVOLVING FIELD

The rotor body is built up of a central solid steel casting cast under pressure with four projecting poles. This central body, shown at A in the cut below, is machined and bored out to a diameter larger than the shaft. Two cross-shaped pieces B

tion. The dovetails on the central body A and on the end pieces B are of such a dimension as to allow the steel tips C to be put into position by sliding in on the dovetail of the central body A. It will be seen that when the laminated pole tips



CROSS AND SIDE SECTIONS OF THE ELECTRICAL END OF THE GLASGOW TURBO-ALTERNATOR

are built at each end of the central body, and carry the rotor on the shaft. These parts are so arranged in reference to the shaft as to leave an annular space all round for ventilation, the openings being shown at K. On the central body A radi-

have been inserted in position and pressed together by means of the steel tips C, they are interlocked and cannot shift. To guard against centrifugal force which would tend to spread the field coils, laterally wedged pieces F are inserted between adjacent coils passing against them and the laminated pole tips.

The field winding is built up of solid copper strip wound on edge, insulated between turns by means of paper and mica, and supported in a special copper spool with heavy insulated flanges. The spools, after being formed and insulated, are subjected to hydraulic pressure in the axial direction of about 50 per cent over the pressure to which they would be subjected from centrifugal action in normal running. The copper winding of the fields bears flat on the insulation, thus avoiding any danger of cutting. The terminal leads of each spool are carried out on the bottom of the spool, and are composed of very thin and flexible copper strips. Between the spools special wedges, already indicated at *F*, are provided against the horizontal component of the centrifugal force, which tends to open the spools. The spools, after being assembled and connected up, are finished on the outside surface, where otherwise the copper would be bare, by means of a special varnish, which is oil and waterproof, and presents a very hard and glossy surface, making it easier to clean the machine. The shaft is a special pressed steel and finished all over, and the rotor is pressed over it with about 100 tons pressure.

The collector rings are of manganese bronze, fixed over a solid steel sleeve, and of special construction as to make it impossible to be subject to deformation under working conditions; the collector rings are shrunk hot over special micanite rings, which are built up directly on the steel shell of the collector ring. The leads from the field coils are carried to the collector rings and are protected by means of special metallic caps which are fitted over the shaft and to the end of the rotor body. The connection of the leads to the collector rings is also protected by a special cap, which is easily removable for inspection if necessary. The finished appearance of the collector rings and rotor body is such as not to have any loose connection or projecting part, making it possible to keep the machine clean when running.

The brushes are of special graphite copper of very low friction co-efficient and high conductivity, and those belonging to one collector ring are kept separate from those belonging to the other. Ample contact is provided on the brushes, and they may be adjusted and replaced if necessary when the machine is running, without interfering with its working.

The exciter is usually designed to give its full load continuously, with a rise in temperature not exceeding 65 degs. F. above the surrounding atmosphere. The exciter is connected to the alternator shaft by means of a flexible coupling on one side, while the other side of the shaft is supported by a spherical bearing provided with oil rings. An efficiency curve of the 3000-kw machine is also given herewith.

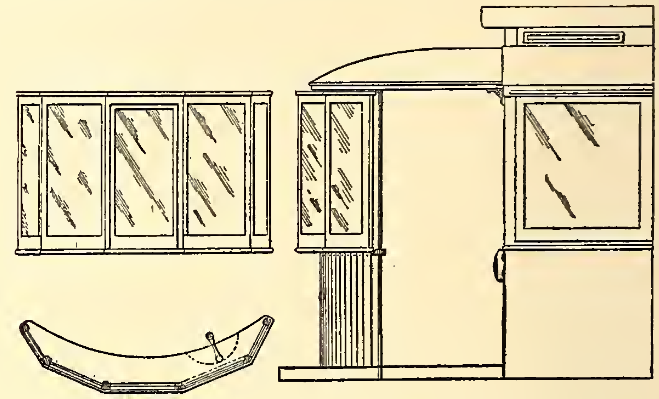
The engravings of the complete unit at Glasgow show the alternator direct connected to a Parsons turbine, manufactured by Willans & Robinson.

THE ILLINI TRAIL

"The Illini Trail" is the title of a recent publication issued by the Illinois Valley Railway Company. When Marquette and Joliet passed through Illinois, the Illini tribe of Indians inhabited the valley now traversed by the railway company, and it was from this source that the name of the pamphlet was derived. The booklet is descriptive of the picturesque valley and the country reached by the traction line. Quite a little space is devoted to weaving an atmosphere of romance about the points of interest along the river by recalling the experiences of Marquette, LaSalle, Tounty and other early explorers in traversing the region. The places where the best hunting, fishing and boating are to be had are pointed out, and in general the matter of the pamphlet is such as to excite the curiosity of the casual reader, producing an incentive to take a trip over the line and causing him to enjoy it the more when he does do so.

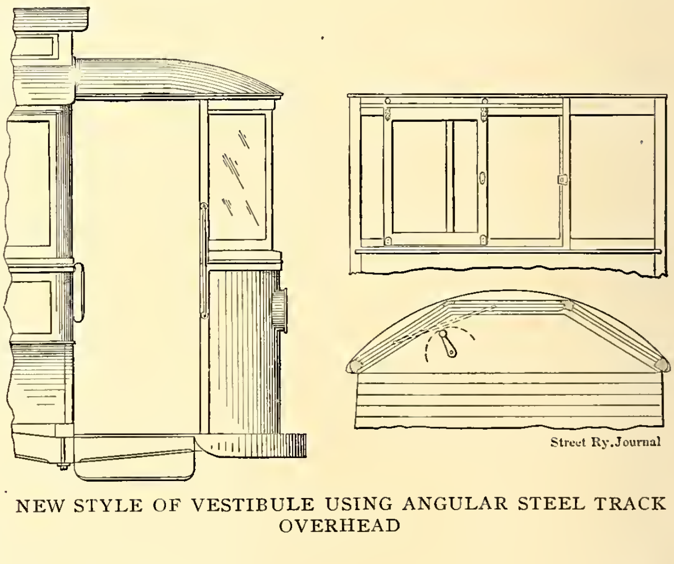
NEW STYLE OF VESTIBULE WITH SLIDING SASH

In connection with the problem of vestibuling closed city cars for the protection of motormen and conductors from bad weather, J. F. Sjoberg & Company, of New York, have recently devised several important improvements which they are now incorporating in both their three-light and five-light vestibules. Instead of hinging the center sash, as has been the practice heretofore, it is mounted on an angular steel track overhead. The degree of curvature of this track is a matter of no consequence, as the sash is provided with swivel sheaves, which



PORTABLE VESTIBULE, WITH SLIDING SASH IN CENTER

adapt themselves to the curvature of the track, while the sash moves diagonally across the angle. The sash is further guided at the bottom in each corner by plates, with rollers running between guide strips, permitting the sash to operate freely above these guide strips. When closed, the sash is held in position by a sash fastening, which also serves as a handle to operate the sash. The side lights are fastened directly into the stanchions or frame of the vestibule. Narrow wooden or brass



NEW STYLE OF VESTIBULE USING ANGULAR STEEL TRACK OVERHEAD

channel stiles may be employed in constructing the center sash, thereby minimizing the obstruction to the motorman's view by using the least amount of opaque material. The so-called portable vestibules are usually made to project a few inches over the dash to allow the free swinging of the controller and brake handles.

Among the advantages claimed for the sliding sash over the usual type of sash which is dropped into a pocket are the following: As the side sashes are not required it is unnecessary to route or groove any pillars for their reception; no pockets involving expensive panel work on the inside of the vestibule are required, and consequently interference is avoided with the headlight, brake and controller stands or other mechanism required at the front end of the car.

The manufacturers of this form of vestibule recently furnished 200 five-light vestibules to the Coney Island & Brooklyn Railroad Company, and 610 three-light vestibules with ¼-in. polished plate glass and brass stiles to the Brooklyn Rapid Transit Company. The latter company has also awarded to J. F. Sjoberg & Company an additional contract for the vestibuling of over 1300 cars, which are practically the balance of the Brooklyn Rapid Transit Company's closed cars. The same company has also adopted the sliding sash for the stationary vestibules on such of its standard closed cars as are now under construction.

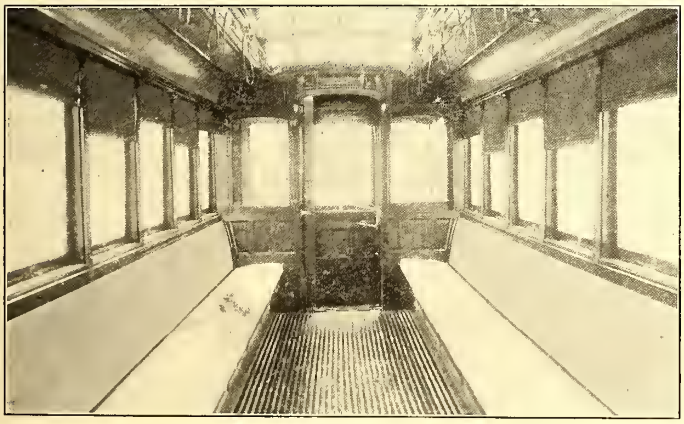
CLOSED CARS FOR JOHNSTOWN, PA.

The Johnstown (Pa.) Passenger Railway Company has lately added to its equipment six closed cars built by the G. C. Kuhlman Car Company. Besides serving the City of Johnstown, with its 40,000 population and populous environs, the railway system includes an interurban line to Windber. The system includes 33 miles of track and seventy-five cars are

SINGLE-TRUCK CLOSED CAR FOR JOHNSTOWN, PA.

operated. The large double-truck cars used were built by the John Stephenson Company. As the cars run in one direction only, the entrances at both ends are on the one side. The forward platform is vestibuled and the rear open. The interior of the cars is handsomely finished in mahogany with birch ceilings. The longitudinal seats are upholstered in spring cane and the seat fronts are paneled in mahogany.

The length of the cars over the end panels is 20 ft., and over the crown pieces, 29 ft.; the width over the sills, including the



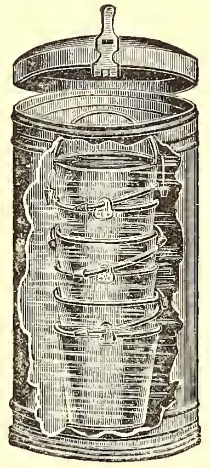
INTERIOR OF JOHNSTOWN CAR

sill plates, is 6 ft. 10¾ ins., and over the posts at the belt, 7 ft. 10 ins.; the sweep of the posts is 5⅝ ins.; the distance between the centers of the posts is 2 ft. 9⅝ ins.; the height from the floor to the ceiling is 8 ft. ⅝ in.; from the track to the under side of the sills, 2 ft. 2¾ ins., and from the under side of the sills over the trolley board, 9 ft. ⅝ in.; from the track to the platform step, 14½ ins.; from the step to the platform, 12 ins., and from the platform to the car floor, 6⅜ ins. The side sills are 4⅛ ins. x 8¼ ins.; end sills, 4¾ ins. x 7¾ ins.; sill plates, 7½ ins. x ½ in.; the thickness of the corner posts is 3⅝ ins., and of the side posts, 2¼ ins. The cars are mounted on Brill No. 21-E trucks, with 7-ft. wheel base, 33-in. wheels and 4-in. axles.

THE SAFETY BUCKET FIRE TANK

Whoever has had some experience with the old-fashioned fire pails and water barrels must welcome the great improvement brought about by the wide introduction of the safety bucket fire tank and enclosed pails, made by the Safety Fire Extinguisher Company, of New York. This tank, which stores the pails vertically by nesting, makes it unnecessary to waste valuable floor space or to suffer the nuisance and danger arising from the presence of open pails and water barrels filled with stagnant water, or, still worse, not filled at all when needed.

The safety fire bucket tank and buckets are made of heavy galvanized iron and lined to prevent corrosion and rust. The tanks are japanned red on the outside, and have a hinged cover which closes down on a rubber packing, so as to make the tank airtight, thus preventing evaporation.



LIQUID-FILLED FIRE TANK WITH NESTOR BUCKETS

The handles of the buckets are so weighted that when the top bucket is removed the handle of the next rises automatically and fills. Each bucket has two lugs on the outside, hence when the buckets are placed in the tank, one inside of the other, they rest on the lugs, and consequently cannot bind or stick.

Every tank is accompanied by a bag of a special compound put up in powder form, with full directions for using. This powder, when dissolved in water, forms the fire-quenching solution with which the tank is filled. This solution, upon coming in contact with fire, immediately forms a gas which has a fire-destroying capacity equal to many times the same quantity of water.

Where the tanks are to be used in exposed places, a compound is furnished that will not freeze in a temperature as low as 20 degs. under zero. The solution contains no acid and is harmless; it does not lose its efficiency with age. When the six buckets have been removed, there is enough solution left in the tank to refill four of the buckets.

The tank, being ornamental and compact in construction, can be put in any convenient or conspicuous place, where it will be sure to be seen and used in case of fire.

PROGRESS ON THE NEW YORK, NEW HAVEN & HARTFORD LOCOMOTIVES

During the past week the first of the twenty-five Westinghouse single-phase electric locomotives ordered by the New York, New Haven & Hartford Railroad for operation on its lines between Woodland and the Grand Central Station in New York City, was received from the Baldwin Locomotive Works, Philadelphia, by the Westinghouse Electric & Manufacturing Company at its works at East Pittsburg. The Baldwin Company, working jointly with the Westinghouse Company, constructs the locomotives and the Westinghouse company provides the electrical equipments. Each locomotive is to be equipped with four Westinghouse single-phase railway motors of the straight series gearless type, and also with the unit switch system of multiple control. It is expected that this first locomotive will be ready to run by the middle of January.

THE PREVENTION OF DUST ON ELECTRIC RAILWAYS

The interest of street railway managers in laying dust on roadways is second only to that of those who have in charge the maintenance of streets and highways. Many companies operating along suburban roads have recognized the importance of preventing dust raised by the passage of cars to the extent of voluntarily sprinkling the right of way. The dust question is important, not only from the standpoint of residents along the right of way, but because of the detrimental influence that dust has on the operating expenses in the way of cost of maintenance of journals and motors, as well as on the like detrimental influence on the gross receipts from passengers who ride for pleasure. Dust is usually the worst in summer, when pleasure riding traffic should be the best. Many electric railway managers, especially those operating over long, suburban or interurban stretches of track, would be glad if something could be found more permanent in its dust-laying effects than water. Not only is it desirable to keep down the dust because of its detrimental effects on lungs, clothing and rolling stock, but the life of the pavement is to a certain extent dependent on how well its surface is bound together, and wherever there is dust on macadam pavement, it is good evidence that the pavement is being destroyed at an abnormal rate. As street railway companies are in many cases responsible for the maintenance of the pavement along their tracks, this point is also of interest to them, since it is to their interest to decrease as much as possible the cost of maintenance and repairs of pavement.

The plan of using water for sprinkling and laying dust leaves much to be desired. Where long stretches of roads on which there is light traffic must be covered, the cost of sprinkling by water frequently may be prohibitive. The dust is laid by the water for only a few hours. Immediately after sprinkling, mud is formed, which is undesirable, both because it may necessitate the use of sand on the tracks and because the mud is secondary only to dust as a general nuisance. Crude oil has been used to some extent as a substitute for water in laying dust, its advantage being that it need be applied only at infrequent intervals. It is not altogether desirable because of its odor and the fact that when fresh the oily dirt from the street is tracked into cars, offices and houses, and further, it renders a street slippery.

Attention has recently been brought in this country to a new solution for street sprinkling purposes called "Westrumite." Although new in this country, it has long since passed the experimental stage in Germany, where it has heretofore been manufactured. The effect of sprinkling with this solution is to bind the material of the roadway together, forming a kind of waterproof surface. The best results are obtained by using Westrumite during the making of a macadam road. Since it acts as a binder, its application at the time the road is made should, of course, make it more effective than sprinkling with it after the road is finished. Nevertheless, some remarkable results are obtained simply by using it as a sprinkling solution. Westrumite is a chemical compound soluble in water. It is mixed up to the strength of a 4 per cent or 5 per cent solution in the ordinary sprinkling cart or car. It is claimed that the periodical application of the compound every eight to twenty days will make any street paved with macadam, granite, brick or wood permanently dustless as far as any dust due to the material of the street is concerned. Asphalt must be treated in a special manner and can only be washed with a weak solution of about 2 per cent once every two days. The cost of the application of Westrumite is almost entirely counterbalanced by the saving in labor, as against sprinkling with water five times per day in the summer, or from 40 to 160 times to each single time that the Westrumite would be applied. Even such frequent sprinkling with water will not give an absolutely dustless street, as it has no permanent binding power on the pavement, and dust will fly as soon as the water is evaporated from the surface. Westrumite dries in one-half to three hours, varying with the temperature, and after it is dry holds down the loose material in the road. One desirable peculiarity is that it is not washed away by heavy rainfall. After a street has been sprinkled with it so that the surface is well bound together, additional sprinklings do not cause the annoying mud that accompanies sprinkling with water.

Some very careful experiments have been carried on by the South Park Commissioners of the city of Chicago. The commission has for some time been treating with Westrumite 2 miles of the Midway Drive connecting Washington and Jackson Parks. A 3½ per cent solution has been used with sprinklings every eight to fourteen days. The result of such treatment is that the macadam paving has the aspect of an asphalt street, and even the worst automobile scorcher cannot raise a dust in passing over it, so firmly is the surface knitted together. Some of the paths in a park have been treated in a similar manner.

A company has recently been formed in Chicago headed by L. E. Myers, T. P. Bailey and other prominent business men of that city, some of whom are well known in electric railway circles. The company is erecting a factory for the manufacture of Westrumite at Whiting, Ind., so that this material will in a short time be available on the American market. The trials that have been made with it so far in this country have been with material imported from Germany.

THE NEW CARS OF THE CLEVELAND & SOUTHWESTERN TRACTION COMPANY

At present, when electric railway associations over the country are devoting so much time to the proper design of interurban cars, it is of interest to note some of the features of a new car built by the St. Louis Car Company for the Cleveland & Southwestern Traction Company. This type of car, of which ten were constructed by the St. Louis Car Company and five by the Niles Car & Manufacturing Company, was illustrated in the Street Railway Journal of Dec. 16, 1905.

These cars are intended to be operated in one direction only. This has permitted the front of each car to be constructed without the usual drop platform, and the added strength of a platform built on the same level with the floor has been attained. The front of the car is circular, which form gives less head resistance.

The principal dimensions of the car are: Length over all, 51 ft.; width over all, 8 ft. 7 ins.; height from the under side of the sill to the top of the roof, 9 ft. 6½ ins. The inside lengths of the passenger, smoking and baggage compartments, into which the interior of the car is divided, are respectively 22 ft. 10 ins., 11 ft. 2½ ins. and 10 ft. 5¼ ins. The floor framing is the St. Louis Car Company's standard for interurban cars, all the longitudinal sills being of yellow pine, while the end and cross sills are of oak. The side sills, measuring 5 ins. x 8 ins., are each reinforced with a 6-in. steel channel running the full length. The center sills are of 6-in. I-beams sandwiched in between yellow pine fillers, while the intermediate sills are of yellow pine, 4½ ins. x 6 ins. in cross section. Heavy steel plates extending the full length of the car back of the letter boards and connected with steel angles and channels in the corner posts of both the front and rear end of the car reinforce the side frames. A combination Gothic sash extends over two of the lower side sash, this latter being arranged to raise. The Gothic sash are made with oval tops, being glazed with green opalescent glass. The deck sash are constructed in three sections, the center section being arranged to swing, while the remaining ones are stationary. The interior of the car is finished mahogany, any undue plainness being relieved by marquetry. Empire ceilings decorated in gold give a lofty appearance to the interior of the car.

The car contains twenty-one stationary seats, covered with green plush and fitted with high back head rolls. The seats are also provided with arm-rests of mahogany and stationary foot-rests. In addition to six stationary seats, the smoking compartment contains a sofa placed against one of the partitions. The car is heated with hot water, the heater being located in the baggage compartment near the partition between this compartment and the smoking room. To prevent baggage from falling over against the motorman and the control apparatus, the front of the forward compartment is provided with a heavy pipe guard. The trucks employed are the St. Louis Car Company's M. C. B. type No. 61, these being machine finished throughout. Rolled-steel wheels are employed, and the St. Louis Car Company's spiral journal bearings are used.

WOOD BLOCKS FOR TRACK PAVING

The problem of paving between street car tracks has been a troublesome one for a number of years, especially in cities like New York, where this work is done at the expense of the railway company instead of the municipal authorities. The problem is especially vexing where a smooth pavement is required.

MAIN STREET, SPRINGFIELD, MASS., PAVED WITH WOOD BLOCKS

Asphalt, which is the commonest of the smooth pavements, is not suited to track work, because the oil drippings from cars dissolve the bitumen and ruin the pavement. Asphalt is also incapable of withstanding the vibration of tracks and ties.

Probably the simplest solution of the problem in found in using wood blocks such as those made by the U. S. Wood Preserving Company, of New York. This pavement is of marvelous endurance. It is easily laid without skilled labor or special appliances, and can be readily removed for repairs to track and electric connections. The simplicity of splitting the blocks with a hatchet, when required, makes it an easy matter to fit the pavement closely in the odd shaped spaces between crossings and switches.

THE TOLEDO & CHICAGO SINGLE-PHASE INTERURBAN RAILWAY

A prominent addition to the interurban field of the Middle West is the Toledo & Chicago Interurban Railway Company, which traverses a well populated section of country in the northeastern part of Indiana. The lines when completed will extend for a distance of about 150 miles, from Goshen, Ind., on the west, where connection is made with the lines of the Indiana Electric Railway Company, to Alvordton, Ohio, on the east. The southern branch from the main line at Garrett extends to Fort Wayne, where it connects with the Fort Wayne & Southwestern Traction Company, the Fort Wayne, Van Wert & Lima Traction Company and other lines converging at this point. The line thus forms a connecting link for the systems of interurban roads extending eastward from Chicago and northward from Indianapolis, and for those connecting Cleveland, Toledo and Detroit and extending westward from Toledo, Ohio.

At the present time 50 miles of road are constructed, extending from Fort Wayne 18 miles north to Garrett, and from there northeast 20 miles through Auburn and Waterloo to Butler, and northwest 12 miles through Avilla to Kendallville, where the power station is located. The extensive character of the total installation when completed, and the fact that high speed, necessitating heavy equipment, can be maintained on the private right of way, rendered advisable the equipment with the General Electric Company's alternating-current single-phase railway system.

The power house at Kendallville is on a good-sized lake, where plenty of condensing water is available. Two 800-kw, 25-cycle Curtis turbine generators with necessary auxiliary apparatus, switchboards, etc., constitute the present central-station equipment. Power will be supplied to the trolley at 3300 volts at the power house, while sub-stations will receive 33,000 volts from transmission lines supplied by step-up transformers in the power house. Each sub-station equipment consists of two 200-kw, 33,000-3300-volt, single-phase step-down transformers, with the necessary switches, meters and lightning arresters.

For the rolling equipment for the 50 miles, ten four-motor General Electric 75-hp single-phase alternating-current compensated type equipments are required, operating eight passenger and two package freight cars. These equipments are suitable for operation on 3300 volts alternating and 600 volts direct current, and are controlled by a cylinder controller serving both for a. c. and d. c. operation. For a. c. operation the controller gives a potential control, varying the voltage applied to the motors, making every point a running point. For d. c. operation the control will be rheostatic. The change form a. c. to d. c. control is made by a commutating switch operated by the reverse handle. The main power circuit is closed by two main switches, one for a. c. and the other for d. c. operation, so interlocked that they cannot be closed together, and so arranged that either one will open automatically if closed by mistake upon the wrong circuit. Each car equipment is furnished with a trolley, air compressor and air brake. The air compressor is driven by a compensated motor operating on both a. c. and d. c. current. The line equipment is 000 catenary construction trolley and three No. 2 copper high-tension line. The rails are 70-lb. A. S. C. E. section. The first cars put in service will run on local service from Waterloo to Kendallville as soon as the northern end of the line is ballasted sufficiently.

SOME INTERESTING RAILWAY SPECIALTIES

A point often overlooked in the construction of tools and other appliances for work in the field is that such tools are usually put into the hands of laborers rather than mechanics, and are consequently subjected to very rough usage. The working parts of such a tool should be covered and protected as well as possible, and the machine itself should be built with lines of strength at every point. That these facts have been appreciated in the design of the drill and tool grinder made by Cook's Railway Appliance Co., of Kalamazoo, Mich., may be seen from the accompanying illustration, Fig. 1, showing the tool grinder mounted on an iron column.

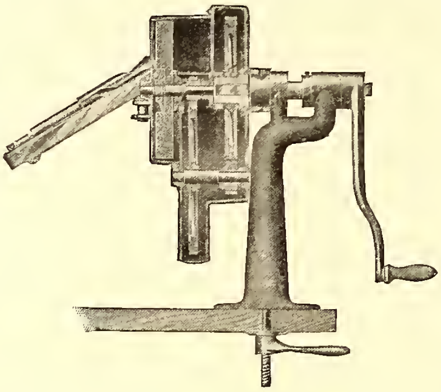


FIG. 1.—TOOL GRINDER MOUNTED ON IRON COLUMN

The tool grinder is intended primarily for field work, being built so that it can be readily attached to the top frame of the company's standard rail drill by removing the crank handle, or it may be used on a malleable-iron column, both of which are interchangeable with the grinder. The emery wheel of the grinder, it may be observed, is driven through two intermediate gears by a crank. These gears, as well as the emery wheel itself, are encased in a malleable-iron shell, which practically insures freedom from injury in the hands of that class of workmen usually employed on track work. The emery wheel is separately encased from the gears, thus avoiding the wearing and grinding effects on the gears resulting from the flying emery dust.

An opening in the disc covering the emery wheel provides for the insertion of the drill to be ground. This is carried in a holding device fitting a socket cast with the disc. By means of an adjusting screw, the drill-bit can be held in exactly the same position with reference to the face of the emery wheel while both lips are being ground, so that a symmetrical cutting edge and the necessary clearance is always obtained. When the bit has once been adjusted to position in the holder, the grinding operation consists simply in swinging the bit-holding device backward and forward. Should it be desired to use the edge of the emery wheel for grinding other tools, the top half of the cover, which is provided with hinges, may be swung back.

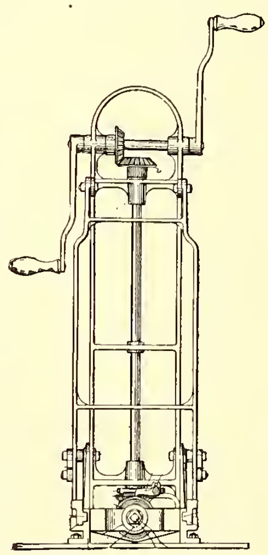


FIG. 2.—RAIL DRILL APPLIED

The emery wheel, which is 6 ins. in diameter and 1 in. thick, is geared to a ratio of thirty-six revolutions to one turn of the crank. The high-speed journals run in brass bushings, the internal bearings being oiled through tubes extending outside of the enclosing shell.

A feature of the Cook standard rail drill is that it is collapsible and can be readily folded to a convenient form for carrying it to different places.

Another feature of much importance besides the variable and reversible feed is that the thrust of the drill-bit holder is taken by a ball bearing, which reduces the friction, and consequently increases the ease of operation. The balls in this bearings are well protected by dustproof caps. It is a great convenience in track drills to be able to change feeds without stopping the drill. The Cook standard drill provides for this, so that it is possible to employ a fast feed until the point of the drill has penetrated to a depth where a slower speed is necessary, when the feed can be diminished. Tests have shown that a 7/8-in. hole can be drilled in 2 minutes and 8 seconds through an 80-lb. T-rail. The same can be done in 2 minutes with ease.

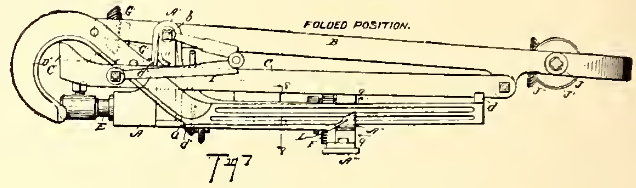
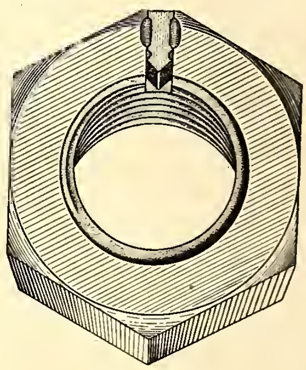


FIG. 3.—DRILL IN FOLDED POSITION

The automatic lowering and track jacks put on the market by this company have many features to recommend them to those in the street railway field. The automatic lowering jack is especially adapted to the many uses to which such a tool is put about a car repair shop. The Cook steel cattle guard is also one of this company's productions, besides a combination wood-steel cattle guard, which seems to be greatly appreciated by the users of such devices.

A NEW LOCK NUT

The accompanying illustration shows the new Burrows lock nut which is being introduced by the American Lock Nut Company, of Boston, Mass., for use wherever a simple and practical device is wanted for the rigid locking of nuts under all conditions. Its mechanical principle is the right angle contact of two cutting edges. In construction it is a rocking key set in a slot in the upper surface of the nut and intersecting the bore of the nut at right angles. In service, the cutting edge of this hardened key engages the softer threads of the bolts, with the result that the nut is held rigidly in place.



NEW LOCK NUT

From the illustration and description given, it is plain that this lock nut is not of intricate or expensive construction, and can be locked and unlocked an indefinite number of times without impairment. To assemble, the nut is unlocked by driving down the outer end of the key until the other end clears the thread, allowing the nut to pass freely on the bolt. When the nut is thoroughly seated, it is locked by driving down the end of the key next to the bolt.

CONDUCTIVITY OF RAILS AS AFFECTED BY COMPOSITION

S. S. Wales contributes an article in a recent issue of the "Rose Technic" on "The Electrical Conductivity of Steel as Affected by Chemical Composition and Physical Treatment." His conclusions are that of the common impurities found in steel, manganese has the most powerful effect in increasing the resistance, also that annealing and tempering on the very soft specimens is of practically no value. On the higher carbon samples, the effect of water hardening on the resistance is quite marked, but the annealing appears to return the steel to its former condition electrically, and nearly so physically.

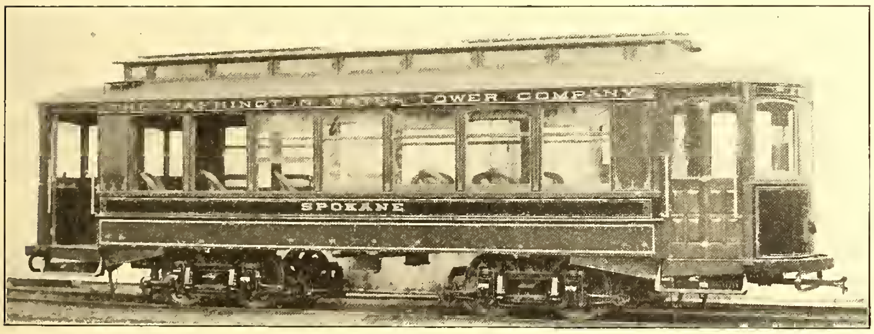
THE QUESTION OF CROSSING STOPS IN LOS ANGELES

By way of providing greater safety to the public, Superintendent Akin, of the Los Angeles Railway Company, issued a bulletin on Monday, Dec. 11, to the effect that on and after that date all the company's cars not having the right of way will come to a full stop at track crossings and where tracks intersect. These cars must stop at least 10 ft. from the nearest cross track. Cars having the right of way must proceed over crossings with the power thrown off, and at not more than 3 m.p.h., under complete control of the motorman, and with the gong ringing continuously. Under the old rules motormen were ordered to have their cars under complete control, and although an excellent system of right of way was devised, the management is of the opinion that the motormen thereunder were allowed too much discretionary power. While this order will lower the time possible between terminals, the officials feel that the increased safety of the passengers will offset the inconvenience resulting. The Los Angeles-Pacific Railroad is in favor of even greater changes. President E. P. Clark would like to have the other companies agree to stop all cars for passengers, either boarding or alighting therefrom, before reaching the crossing, instead of on the other side of the crossing. Superintendent Akin, of the Los Angeles Railway Company, has not approved the idea. He does not question the value of the plan as a safety proposition, but is of the opinion that it would take too long to educate the public to the change.

SEMI-CONVERTIBLE PARLOR CAR FOR THE WASHINGTON WATER POWER COMPANY

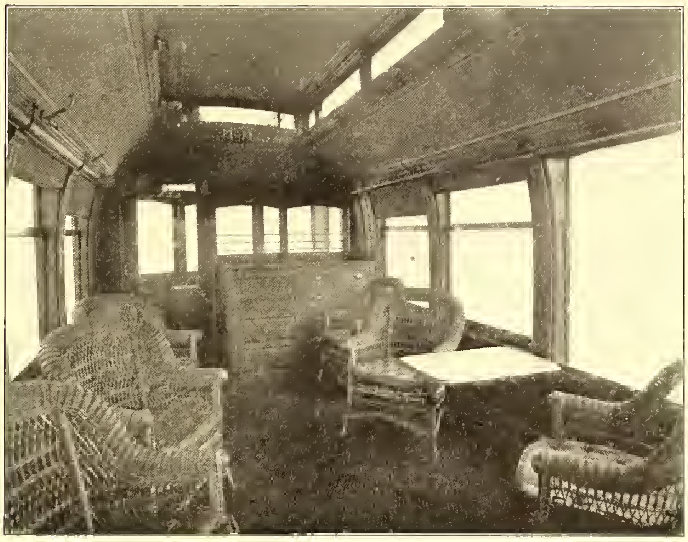
The handsome parlor car which is shown in the accompanying illustrations has just been shipped to the Washington Water Power Company by the J. G. Brill Company. It is for the use of the officers and directors of the railway, and will be rented also to private parties for excursion purposes.

Spokane has a population of 40,000 and is the principal railway center of the State. The suburbs are extensive and include a large number of populous towns. The city is noted for its fine streets and buildings, and the scenery in the neighborhood, which may be seen from the lines of the railway company, is unusually interesting. The company has a trackage of about 75 miles and has nearly 100 cars in operation. It owns Natatorium Park and furnishes power to the Coeur d'Alene mines, which are 100 miles from Spokane. The Brill Company has furnished a large part of the rolling stock of the Washington Water Power Company; five lots of cars were of its convertible type, and the last lot of ten cars, semi-convertibles. A lot of twenty semi-convertibles of the grooveless post type, measuring 30 ft. 8 ins. over the bodies, is being built at present.



DOUBLE-TRUCK PARLOR CAR USED IN SPOKANE AND VICINITY

As may be seen from the view of the interior of this car, there has been very little attempt at ornamentation. The woodwork is of quartered oak in its natural color, rubbed to a dull finish. A commodious closet at one corner of the car has a refrigerator in the lower part, with the compartments conveniently arranged. A narrow closet with hinged cover at the top, is placed back of the door in the corner at each end of the car to store the tables when not in use. The wicker chairs are stained the same color as the woodwork and have leather cushions. A seat accommodating three passengers is built against the end of the car opposite to that shown in the illustration of the interior. The backs and cushions are comfortably upholstered in leather, and it has the appearance of a lounge. The floor is of hard wood and covered with a carpet rug. Light-green buckram covers the birch veneer head linings, and is striped and decorated with gold. The entire effect is very pleasing, particularly because the car is lighted by extra large windows, the centers of the posts being 3 ft. 6 ins.



AN INTERIOR VIEW OF PART OF THE SPOKANE PARLOR CAR

It will be seen that the window system is the Brill grooveless post, semi-convertible type, and the car is the first to have all the windows of this large size. Semi-convertible cars, which the builders furnished to the Boston & Worcester Railway a year ago, had two large windows at each end, but the rest of the windows were of the ordinary width, namely, 2 ft. 8 ins. from center to center of posts. As the platforms will be used for observation purposes, they are made 5 ft. long. The doors in the body ends, as will be seen in the view of the interior, are single and swing inwardly. The car is equipped with four "Dumpit" sand boxes, which are placed under the platforms, with small, neat cover-plates set into the flooring of the platforms. The horizontal brake wheels, channel-iron draw bars, angle-iron bumpers, platform gongs, signal bells and other specialties are of the builder's manufacture. The car measures 28 ft. over the body and 29 ft. over the vestibules; width over sills, 8 ft. 2½ ins., and over the posts at the belt, 8 ft. 6 ins. It is mounted on No. 27-F trucks, with one 40-hp motor per truck.

Manager E. S. Dimmock, of the Canton-Akron system, has arranged for the sale of theater tickets for attractions at Canton, at various points along his line. Each theater ticket contains coupons good for transportation to and from Canton. By this plan the company is enabled to provide plenty of cars and furnish a seat to every passenger to and from the show. The first night the excursions were instituted the company carried 400 people from Massillon and 200 from Akron to Canton.

LONDON LETTER

(*From Our Own Correspondent.*)

Last month reference was made to the fact that the city of Lincoln would soon be equipped with a system of tramways, and that special interest attached to this system on account of the fact that it would use the Griffiths-Bedell surface contact system. After being examined by the inspectors of the Board of Trade, who granted the Corporation permission to put it in operation, the system was formally inaugurated, the Mayor and the chairman of the electricity works committee and other officials of the Corporation being present at the ceremony. After the trip the members of the Corporation were received at the Saracen's Head Hotel by Mr. Griffiths and Mr. Bedell, who were both extremely pleased with the results. The length of the new line, at present, is about 2 miles, and the contract has been carried out by Griffiths & Company, of London. The eight cars, which are at present in service, were constructed by the Brush Electrical Engineering Company.

It is a pleasure to be able to report that the great task of electrifying the Metropolitan District Railway has at last been completed. There are now in the tunnels of the Metropolitan District Railway no steam-drawn trains. The progress of this system has been reported in these columns from time to time, so that it will be remembered that the whole electrification scheme was practically completed some months ago. However, as the half-hourly trains of the London & Northwestern Company, which run from the Mansion House to Broad Street, were still being operated by steam locomotives, the service was handicapped. These steam locomotives have now been replaced by electric locomotives, which are attached to the train at Earl's Court. Mr. Yerkes and the engineers of the Metropolitan District Railway Company are to be congratulated on this most satisfactory completion of their great work, which will now be followed up rapidly by the other underground railways with which Mr. Yerkes is associated. It is to be hoped that the Metropolitan Railway Company will also soon make a special effort to get the steam-drawn trains, which are still running over its portion of the system, withdrawn. On the whole southern portion of the Inner Circle from Aldgate to Earl's Court, there are no steam-drawn trains, but unfortunately on the northern portion of the circle, owned and operated by the Metropolitan Railway, a good many steam-drawn trains are till in service. One of the immediate results of the withdrawal of the steam trains from the Metropolitan District Railway, is the very appreciable quickening of the whole train service. A long as the steam trains were in operation, the electric trains had to wait at the station for considerable time, as they had to run on the schedule of the old steam trains. Now that these have been withdrawn, the increase in speed is appreciable over all the line, and as soon as the automatic signaling devices are completed, it is understood that a still further increase will be possible.

The London County Council is now definitely committed to the promoting of a bill in Parliament for supplying electricity in bulk to London, and the various committees have been in consultation with Sir Wiliam Preece, Robert Hammond, John F. C. Snell and others. From the strong opposition which this bill will receive, it has already undoubtedly been modified, and the scheme now submitted will provide for the co-operation of the London County Council with the already existing authorities and companies which are now producing electrical energy. It is proposed that for the present the supply should be taken from the Greenwich power house, which the Council has been erecting for the last two years to provide power for the electric cars, and for this purpose that station would be hurried towards completion. It is also intended to proceed with the erection of another station in the west of London on the banks of the Thames, near the Grosvenor Road Railway bridge, on a site which is now possessed by the Metropolitan Water Board. On this property, a station with a capacity of 80,000 kw would be built. The total capital necessary for such a scheme would be about £2,500,000, the expenditure being spread over a period of seven years. This is not the whole expenditure, however, that the London County Council is committed to at present, as it has also decided to proceed with a bill to acquire a site for the proposed new County Hall. This will involve an estimated expenditure of £1,700,000. It has also decided to proceed immediately with the electrification of the northern system of tramways, and the immediate expenditure necessary for that is the sum of about £800,000. This section of the northern system comprises the lines between Theobald's Road and London Docks, Norton Folgate and Stamford Hill. Aldgate and Poplar, Moorgate and City Road, Holborn and Theobald's Road, and Old Street and Shoreditch. The committee hopes to have the lines in working order about the end of 1906.

It is now possible to give a little further information regarding the promotion of an electric power scheme referred to last month. This scheme is now generally known as the "St. Neots," or "railway" power scheme, and a syndicate has been formed with the necessary capital to promote the bill in Parliament. The directors of the syndicate are stated by the articles of association to be Stanley Boulter (chairman), George Kitchin, and H. A. Vernet, and the names of the members of the syndicate comprise a very influential body of men. The engineers mentioned in connection with this bill are Messrs. Kincaid, Waller, Manville and Dawson.

The object of the bill is the supply of electric energy in bulk to railways, Metropolitan Borough Councils, and existing electric supply companies. The promoters are, we understand, directing their attention mainly to the supply of the great London railways, for the electrification of whose suburban traffic a very large amount of power will in the near future be required; but negotiations are also pending for supplying in bulk municipal and other electric undertakers. The promises of support which the St. Neot's scheme has received from railway companies show that the promoters are fully alive to the importance of having a strong group of capitalists ready to assist them by providing the money necessary for a great electric power scheme, which will obviate the necessity of the railway companies themselves adding to their own capital.

During the past month the electric tramways of the Corporation of Belfast have been formally opened and duly put into regular service, and the contractors, J. G. White & Company, of London, are to be congratulated on the successful completion of a most important piece of work. The usual ceremonies in connection with the opening of a system were held, when the Lord Mayor, as in most other towns, had the honor of driving the first car, accompanied by many of the other officials of the Corporation, together with Mr. Fisher and Mr. Connett, representing J. G. White & Company, the contractors. The first run was along Bedford Street, Dublin Road, University Road, and Malone Road, as far as Cranmore Park; the return route being made by the same route as far as Ulster Hall, whence they proceeded, via Ormeau Avenue, to Rosetta, and then back to Donegal Place. Altogether, a distance of 17 miles was traversed, and as the arrangements had been most carefully planned under the personal supervision of Mr. Nance, everything went off with the utmost success. The usual Board of Trade inspection duly took part, and everything was approved by Major Pringle, the representative of the Board of Trade on this occasion. It is hoped to give some further details of this interesting equipment in these columns on another occasion.

Parliament will be asked in the forthcoming session to sanction a scheme under which a company will be incorporated and granted power to construct and use various tramways and tramroads in the parish of Huddersfield, in the county borough of Huddersfield, the parish of Rastrick, in the borough of Brighouse, and the parishes and urban districts of Elland, Greetland and Hipperholme, and in the parishes of Fixby and Clifton, in the rural district of Halifax.

In the hope of overcoming some of the congestion of traffic at the Elephant and Castle, South London's most dangerous street crossing, Southwark Borough Council is considering the advisability of building a street subway, to cost from £10,000 to £13,000, for pedestrians. For years the "six ways" at the Elephant and Castle have constituted one of the most congested junctions in London streets, and the growth of the County Council's electric car service has increased the trouble.

In proceedings in the Chancery Court of Lancashire, it was announced that the undertaking of the South Lancashire Electric Traction Company had been sold for £150,000 to Arthur Stanley, M. P., who was acting on behalf of himself and other debenture holders. It is now stated that all the capital for the new company has been subscribed, and that the whole of the work is expected to be completed in 12 months' time, when Manchaster and Liverpool will be linked up. When the tramway lines are extended through Worsley and Walkden to Eccles and Swinton it will be possible to travel by car from Manchester to Liverpool.

A company has been formed to erect a transporter bridge across the Tees from Middlesbrough to Port Clarence in place of the present horse and car ferry, and also to construct in connection with it a light railway or tramway from Middlesbrough to Port Clarence, Billingham, Cowper Bewley, Greatham, Seaton, Seaton Carew, and West Hartlepool. As the scheme is in competition with the Middlesbrough Corporation ferry service, opposition to the powers to be sought is not unlikely.

The official opening of the electric tramway service through Alexandra Park recently, marks the commencement of a new era in the "life" of the great house on Muswell Hill. The difficulty in the past has been to get easily and cheaply to the Palace; the democratic electric car has once for all settled this, as it is now possible for visitors to get from almost any part of London, by traveling in conjunction with the L. C. C. tramways, to within a few feet of the portals of the Palace itself.

Sir Francis Cory-Wright started the new service at Turnpike-lane, and within a few minutes the first car, containing the directors of the Metropolitan Electric Tramways, Ltd., drew up at the terminus.

Another has been added to the schemes for constructing tramways in the Macclesfield district. The promoters are a syndicate which includes a member of well-known tramway directors, and it is announced they intend to construct lines through Tytherington, Butley, Adlington, Poynton, and on to Hazel Grove, where they will join the Stockport tramways, making a total length of line of 18 miles. It is also probable that another scheme for a tramway from Macclesfield to Knutsford will shortly be announced.

The Croydon Borough Council has refused the offer of the British Electric Traction Company for the renewal of the lease of the tramways, which the company has been working since the electrification of the system five years ago. The questions of municipalization will be considered at a future meeting, but Alderman Stapleton, chairman of the tramways committee, said the committee regarded complete control by the Corporation as the only alternative to the company's offer. The lease of the system expires next year. The offer made by the company, and now rejected, was equivalent to an extra payment of £4,000 a year to the Corporation.

Major Druitt, of the Board of Trade, recently inspected the new electric tramways between Dewsbury and Birkenshaw, the construction of which has just been completed. The old steam cars ceased running at the beginning of August, and as 4 miles of rails (a good portion double) have been laid, the contractors (Dick Kerr & Company) have lost no time in finishing the work they have had in hand. The Batley, Dewsbury Corporations, and the Birstal, Gomersal, and Birkenshaw District Councils, were represented at the inspection, while there was also a large number of officials from the British Electric Traction Company and the Heavy Woollen District Tramways Company. There was no hitch in the running of the two cars by which the party traveled over the route, and a public service was started at noon. A. C. S.

PARIS LETTER

(*From Our Regular Correspondent.*)

The automobile exposition now being held at the Grand Palais has brought more than ever into prominence the fact, that Paris lags far behind other great European capitals in respect to motor omnibuses. The reason is not far to seek when it is remembered that the omnibus lines form a concession—formerly a monopoly—operated by a single company. The franchise expires in a very short time, less than three years, and the doubt entertained by the company in respect to its renewal, regarding which nothing definite can be obtained from the municipality, is responsible for the hesitation shown by the Cie Generale des Omnibus in placing mechanically-operated vehicles on the streets. In view, however, of the possible renewal of its franchise, the Cie Generale has now definitely taken in hand the question of mechanically-propelled buses, and for several months past experimental buses have been running loads with sand bags for freight. During the present automobile show a line of nine mechanically-operated buses has been plying between the Bourse and the Grand Palais. The company states that if sufficient encouragement is shown by the municipality it is prepared to place in public service several lines of motor buses. One of these lines is to be operated with buses whose motors will use alcohol for fuel. The price of this fuel is not exorbitant, as compared with the price in Paris of gasoline, and it can be obtained for commercial purposes at about 8 cents a litre or less. The price of gasoline in Paris is high, on account of a heavy import duty, and also an octroi tax, which latter is 4 cents per litre. Thus the price of gasoline for motors is close to 12 cents per litre.

Meanwhile, the surface traction situation in Paris remains still in a very critical stage, and nobody can foretell the next move, or the future policy of the municipality. It is pretty certain that nothing like municipalization of the tramway service on a large line will be attempted or suggested for the present, the situation being less favorable in this respect than with regard to the lighting concession, which is also in suspense together with the question of gas monopoly. The transport question is sure to come up for discussion sooner or later, but in the meantime the public, as well as investors on the stock market, are apparently losing confidence, and stocks and shares of Paris transport companies have recently sustained a sharp reaction. It cannot be said that this is in any way due to the intention of the municipality in regard to municipalization of the tramway service, since this matter is being very tenderly approached by the authorities, the conflicting interests being too great to lightly suggest any sudden change. At the same time it cannot be denied that several companies are keeping the matter in mind and are ready to carry on a strong fight if the matter happens to be touched upon.

The receipts of the Paris General Omnibus Company, have, throughout 1905, shown a steady decrease on the figures of the preceding year, the loss of receipts being in the neighborhood of $10,000 per week and over.

THE A. E. & C. AND THE E. A. & S. CONSOLIDATION

L. J. Wolf, president of the Aurora, Elgin & Chicago Railway Company and the Elgin, Aurora & Southern Railway Company, has sent an official announcement to the stockholders of these companies, of a plan for the consolidation of these properties along the lines referred to recently in the Street Railway Journal. The plan also contemplates the building of a short spur line, from which he states large revenue can be derived from funeral and cemetery traffic, and the consolidation of this line with the consolidation mentioned. Possibly a second short spur line may be built. The new company will be known as the Aurora, Elgin & Chicago Railroad Company, capital stock $6,200,000, half preferred. Stock will be distributed to stockholders of the old companies on the basis mentioned last week, leaving $100,000 to pay for the spur line mentioned. The directors of the two companies will meet within a few days to ask authority to bring about the consolidation.

ANNUAL MEETING OF THE BOSTON ELEVATED

The annual meeting of the Boston Elevated Railway Company was held at Wesleyan Hall last week. President Bancroft presided, with John T. Burnett as secretary. There were less than a dozen stockholders present. The following were re-elected directors by a vote of 83,252 shares out of 133,000 outstanding: Frederick Ayer, William A. Bancroft, John J. Bright, Samuel Carr, T. Jefferson Coolidge, Jr., Frank E. Peabody, James Phillips, Jr., James M. Prendergast, N. W. Rice, Quincy A. Shaw, Jr., William S. Spaulding, Walter S. Swan and Robert Winsor. The annual report of President Bancroft was printed in the last issue of the Street Railway Journal. Appended are some remarks by Mr. Bancroft of the present condition of the company:

"Work upon the extension of the elevated structure to Forest Hills has been prosecuted. Plans have been made, much of the steel material for the structure has been got out, and the foundation piers have been built for about half the distance between Forest Hills Square and Dudley Street. It is expected that the erection of the structure will begin in the spring.

"The East Boston tunnel has been in successful operation during the calendar year, and cars of large size have been in use therein. One of these cars, seating 52 persons, was designed and built by the company, and, with minor changes, will probably be adopted as a type with which to fully equip the lines which enter the tunnel. Forty other cars, all of large size, seating 48 persons each, have been bought, and some of them are in use in the tunnel, others are in use on the lines reaching the elevated trains at Sullivan Square.

"Much progress has been made by the Boston Transit Commission in constructing the tunnel under Washington Street. The route and the location of stations so far have been satisfactory to the company, and, it is believed, most convenient for the public.

"The operation of the new schedule of wages adopted two years ago has increased wages during the last year $170,834. The increase in the total number of revenue passengers for the entire systems was 2.18 per cent, as against about 3½ per cent in 1904, and 5 per cent in 1903. Unusual attention was paid to the care of the company's surface tracks, $622,849 having been spent thereon in renewals and repairs. This exceeded the amount spent in the previous year by $169,179. It is believed that the company's tracks were never before in such excellent condition. The extension of the surface tracks amounted to 1761 miles, making total length of surface tracks controlled by the company, including that leased from the Old Colony Street Railway Company, 431.891. This with the elevated mileage of over 16 miles, makes a total mileage of 447.906 miles."

The report announces that the company received a premium upon its issue of $7,500,000 4 per cent 30-year bonds sold last April of $276,900, showing that they were sold at 103.692. The income account and balance sheet have previously been published.

BRITISH COMMENTS ON THE NEW YORK CENTRAL.—NEW HAVEN SITUATION

Some interesting letters have recently appeared in the "London Times" on the subject of single-phase locomotives on the New York, New Haven & Hartford Railroad, which has attracted so much attention in this country. The contributions of Prof. Silvanus P. Thompson, H. F. Parshall and Prof. Alexander B. W. Kennedy, which are the most interesting of those which have appeared, are reproduced below.

Technical College, Finsbury, Oct. 23.

SIR:—The letter of "British Engineer" in "The Engineering Supplement" of Oct. 18, commenting on the paragraph entitled "Development of Electric Traction," on page 264 (Oct. 11), which referred to the development of single-phase electric motors for propeling trains on the New York, New Haven & Hartford Railroad, exhibits the very quality which its writer condemns. He objects to the severe criticism of the third-rail system as being likely to prejudice the public mind, and describes the paragraph as a sweeping condemnation of the views held by British engineers, whom he represents as unanimous in upholding the system of employing a third rail, the system adopted with continuous currents at a relatively low voltage on the Inner Circle System. But this presentation is surely an exaggeration. It is notorious that engineers are by no means unanimous in their approval of this system. One has only to look at the mass of conductors piled against the walls of the tunnels between Earl's Court and Charing Cross to realize what a disproportionate expenditure on copper this system involves. That wall of copper conductors is a striking object lesson of how not to equip an electric railway. I need not enlarge on the difficulties of the third-rail system in the complications of crossings, sidings and shunting-yards; they are only too obvious. It is notorious that changes have already been suggested—too late, I fear—in the system of the District Railway. The old obstinacy of refusing to admit the virtues of anything that "has yet to be tried, at any rate, in this country," is characteristic of too many "British engineers." They shut their eyes to the experience that has already been gained in single-phase propulsion with overhead conductors, in Germany, in the United States, in the Valtellina, and in the Stubaithal. Only when an order is placed with the Westinghouse Company for twenty-five locomotives, of 1000 hp each, which work with single-phase current and dispense with the third rail, do they wake up to cry out that "experience with the newest system does not justify a sweeping condemnation of the views held by British engineers." Perhaps it does not; but it justifies a sweeping condemnation of those British engineers whose vision is limited to those "views." By holding narrow views they have done their best—or worst—to rivet on our British railways, regardless of the progress of invention, "the dangerous, inconvenient and expensive third rail."

I am, sir, yours faithfully,
SILVANUS P. THOMPSON.

Salisbury House, London Wall, E. C., Oct. 26.

SIR:—It is not my intention to enter the lists as a champion of either the high-tension alternating current or continuous-current systems for the propulsion of trains. I fully recognize that under given conditions either system may be the more advantageous. I may, however, take exception to the arguments advanced in favor of the universal use of alternating-current motors. Broadly speaking, the advantages and disadvantages of each system are very largely of a commercial nature. I was among the first to employ alternating current in traction work, but I stopped short of using it in the distribution system. The limitations which then seemed present still exist, and, under identical working conditions, prevail to the same extent.

There is no doubt that an alternating-current train system can be made as reliable as a continuous-current system. However, where runs are short and the greater part of the work to be done lies in accelerating and maintaining speed rather than running at fixed speed, the motors required for the alternating-current system are much heavier than for the direct-current system. In the extreme case of acceleration to which continuous currents are applicable the weight of the alternating-current equipment is prohivitive. The main question to be decided in all cases is the balancing of additional cost of train equipment against diminished cost in transmission and transformation. The difference in electrical efficiency may be taken as unimportant. With the same general transmission system the lower power factor and lower efficiency of the alternating-current train equipment may be taken to offset the energy losses of transformation in the continuous current as commonly used in the heavier class of railway work.

A great deal has been said as to the objectionable features of the commutator of the continuous-current machine. It has, however, been found to be practically impossible to develop an alternating-current motor suitable for traction work, without a commutator similar, but larger, than that employed in the continuous-current system. Furthermore, a high-tension transformer is necessary to secure the full advantages of the alternating-current system.

Referring more specifically to Prof. Silvanus Thompson's recent letter, I may point out that the limiting feature of the alternating-current system, apart from that of the motors under acceleration, is the drop in the return circuit if uninsulated. This drop is several times greater in the alternating-current system, per ampere, than in the continuous-current system. In heavy working an insulated return or its electrical equivalent becomes a necessity. Experiments have shown the impracticability of working a heavy train service by alternating currents with track return, in any locality equipped with systems of telegraphs and telephones.

As regards first cost, the third rail is much cheaper than the ordinary overhead system; but this, however, is not the determining factor. As regards reliability, experience is clearly in favor of the third rail. As regards the danger of the third rail, experience shows that, even when unprotected, accidents are very rare. In a specific case in London, an overhead system installed under the best auspices for heavy haulage over a complicated network of tracks, was found to be a failure, and was replaced by the third-rail system, which was found to be entirely safe and reliable.

While I am in no way interested in the District Railway installation, I would point out that the particular cables to which Prof. Thompson alludes are for alternating-current transmission, and are not incident to the use of the third rail. Were the alternating system used throughout, the number of these cables would have to be greatly increased.

I do not for a moment suggest that there are not conditions under which I would apply alternating current generally in a traction system. I have investigated the conditions under which this alternating current has been applied on the Continent and in the United States. For the lighter class of railways, working over considerable distances with moderate acceleration and moderate tonnage, a single-phase system possesses certain commercial advantages. The New York, New Haven & Hartford Railway is a locomotive installation. Hence the acceleration is limited, and a class of apparatus is permissible that is entirely unsuited to motor-car working. In my opinion, the relative applicability of the two systems is wholly one of degree, and there is no general prescription which can be safely or reliably applied in the economical propulsion of trains.

I have heretofore pointed out that in an electrical system the third rail is the most reliable and the least troublesome element in the whole traction system, as either the evidence of the Board of Trade or the responsible officials of the different electrical railways will confirm. The third rail has been singled out as the evil peculiar to continuous-current systems. When the same conditions are met in an alternating-current system, it remains to be seen whether it can be dispensed with.

It has been suggested that the third rail was not the creation of an electrician. I believe the Hopkinsons first suggested this form of conductor. Considering that it has been adopted, practically universally, for heavy traction by the engineers most responsible for the advanced state of the art, it cannot be lightly put aside and superseded by something yet to be proved suitable for the same class of work.

In conclusion, I may point out that the broad problem before electrical engineers is to demonstrate, from experience gained in electrical working, the conditions under which electricity may profitably compete with steam. The solution of this problem is not so self-evident that time-tried inventions can be casually set aside.

I am, sir, yours faithfully,
H. F. PARSHALL.

17 Victoria Street, S. W., Oct. 31.

SIR:—In reference to Prof. Silvanus Thompson's letter of the 23d inst., in "The Engineering Supplement" of Oct. 25, I think it is only fair to ourselves to point out that the adoption of the "third-rail" system on the District and Metropolitan Railways was not due to any conservatism or obstinancy on the part of British engineers. Quite the contrary. It was due entirely to the pressure of American engineers on the arbitrator that no system except the "third rail" could possibly be commercially successful under the circumstances, and to the statements made that the American financial people would work on no other system. These considerations weighed so much with the learned arbitrator that he entirely threw out the alternative Valtellina system, and he also ruled (which was much more important) that he could not receive evidence as to any other alternative. Many English engineers, including myself, both believed and pointed out, long before the matter was taken up (as I am glad it has been) on the Continent and by the Americans, that the single-phase system, with one overhead conductor, was the only probable solution of the heavy railway question, and our opinions seem now to be shared by engineers generally.

Yours, faithfully,
Alex. B. W. Kennedy.

AFFAIRS IN CHICAGO

At the recent conference of the city officials and the officers of the companies regarding the operation of more cars during the rush hours, the traction interests advanced the plea that the substitution of the trolley for the cable is the only remedy for overcrowding and the congestion of traffic in the down-town districts. With this opinion A. B. Dupont, who has been acting as personal adviser to Mayor Dunne, agreed. Mr. Dupont admitted that the Union Traction Company had reached the limit of its power capacity, and that few more cars could be operated where needed on the Chicago City Company's terminals. Conferences between President Roach of the Union Traction Company and President Mitten and General Counsel Bliss of the Chicago City Company on the one side, and Jacob G. Grossberg and Dr. M. F. Doty of the local transportation bureau, and Mr. Dupont, representing the city on the other, occupied most of the day. In the morning the city's representatives pointed out to President Roach the congested conditions of the North and West Side lines and asked him to remedy them. Mr. Roach said the company was operating all the cars its engine capacity would permit. He said the power now used exceeded the safety limit, and that it would be impossible to put more cars on the cable lines because the cable engines could not propel them. Mr. Mitten said the only relief for the congestion on his lines was to convert the cable in State Street into a trolley. If this was done, thousands of passengers would use the line who now go to Indiana or Wentworth Avenue to come down town, because of the superior accommodations offered by the electric cars. He thought the trolley on the State Street line to Van Buren, and Van Buren between Wabash Avenue and State, would add to the terminal facilities during the rush hours. He proposed a loop on Wabash Avenue, State, Van Buren, and Eighteenth Streets. Mr. Dupont favored bringing the trolley down town. Dr. Doty will report the suggestions to Mayor Dunne.

At the joint meeting of the local transportation and track elevation committees, ordinances were considered for the extension of the franchises of the Chicago & Oak Park Elevated Companies until 1944, and the construction of two branches to that line—one on Western, North, and California Avenues to Humboldt Park, and the other between the Belt Railway and Forty-Ninth Avenue to Augusta Street, and thence to the city limits. These ordinances were considered in connection with the elevation of the tracks of the Northwestern steam railroad and the surface tracks of the Chicago & Oak Park Company through Austin. No action was taken.

Representatives of the traction companies have notified Corporation Counsel Lewis that they intend to attack the validity of the Kohout ordinance and other measures regulating the street car service. The attacks will be based on the indefiniteness and unreasonableness of the ordinances. General Counsel Gurley, of the Union Traction Company, has had a conference with Mr. Lewis and Special Counsel Grossberg and has arranged for the postponement of the cases now pending in the justice courts until after the hearing in Washington. Mr. Gurley said he and John P. Wilson, representing the Chicago City Company, would attend the trial of the cases for the purpose of laying a foundation for an injunction suit to restrain the city from attempting to enforce the ordinances regarding the heating, ventilating, and crowding of cars. Mr. Gurley said the ordinances did not define what constituted overcrowding of cars, whether any passengers should be allowed in the aisles or on the platforms. Another point urged against the validity of the ordinances was that they provided a penalty of $50 for violating any of their provisions. Mr. Gurley said some of the violations might not be sufficiently punished with $500 fines, while in other cases $1 would be an ample penalty. It will be argued that it is impossible to enforce some of the provisions of the ordinances and that for this reason they are illegal. Major Tolman will open the arguments on the merits of the case and will be followed by Glen E. Plumb on the same line. Clarence S. Darrow will close the arguments for the city covering the entire case. Attorneys for the Union Traction Company will alternate with the city's lawyers. S. S. Gregory will act as general adviser in the case. Two cases will be argued at the same trial. In one case the company has appealed because Judge Grosscup did not hold that the 99-year act covered all its lines, and in the other the city is the appellant because Judge Grosscup recognized the validity of the 99-year act in any particular.

MILWAUKEE COMPANY TO ISSUE BONDS

The Milwaukee Electric Railway & Light Company, which is controlled by the North American Company, has taken steps to issue $20,000,000 of 4½ per cent twenty-five year bonds, to be used in part for the retirement of present bond issues and partly to provide capital for extensions and improvements. The stockholders of the company will meet in Milwaukee on Jan. 5, to authorize the new issue. About $8,000,000 of the bonds will be reserved to retire at maturity the bonds of the Milwaukee Railway & Electric Company's subsidiary concerns. This will leave about $12,000,000 of bonds available for increasing the facilities of the company.

The Milwaukee company owns all the railway lines in Milwaukee, as well as all the lighting plants, and supplies, in addition, a large amount of electric power. The demand for the latter, it is said, has outgrown the facilities of the company, and it is intended to largely increase this branch of the company's business.

The entire issue of bonds has been underwritten by three New York banking houses, Spencer Trask & Company, F. S. Smithers & Company, and N. W. Harris & Company. The present bondholders will have an opportunity to exchange their holdings for bonds of the new issue The company has outstanding $8,000,000 of common and $4,500,000 of preferred stock.

NEW POWER PLANT IN HARRISBURG

The Central Pennsylvania Traction Company, of Harrisburg, is excavating for its new power plant, which will be located adjacent to its old No. 1 plant on South Cameron Street, Harrisburg. The new plant will be of ample capacity to take care of all their power requirements for the immediate future and will replace three plants the company now has in service.

The building will be 175 ft. long, 102 ft. wide and about 40 feet high. It will be constructed with a steel frame which is being manufactured by the bridge and construction department of the Pennsylvania Steel Company. Walls will be built entirely of concrete filled in between the steel columns.

The equipment will consist of three horizontal cross compound, condensing Corliss engines of 1000 hp, now building by the Allis-Chalmers Company, of Milwaukee, Wis. Each engine will be directly connected to a 650-kw generator also furnished by the Allis-Chalmers Company. These units will have a capacity of 50 per cent overload for short periods, thus giving a maximum capacity for the entire plant of about 4500 hp.

The engine room will be 50 ft. wide and will extend the full length of the building, 170 ft., and will face Cameron Street. Large windows in the face of the building extending to the engine room floor, which will be 9 ft. above the street level, will give a full view of the interior of the engine room from the street. A traveling crane operated by electric motors will serve the entire engine room floor and will have a capacity of 30 tons. The boiler room, which will occupy the rear portion of the building, will be 45 ft. wide and extend the full length of the building, and will contain for the present five 327-hp horizontal water-tube boilers now being manufactured by E. Keeler Company, of Williamsport, Pa. All of the above equipment will occupy only one-half of the floor space of the building, ample room being provided for installation of additional boilers and engines as the growth of the system requires, so that the plant will have an ultimate capacity of 9000 or 10,000 hp.

The stack will be built of reinforced concrete by the Weber Steel Concrete Chimney Company, Ill. It will rest on the solid rock about 20 ft. below the present ground level and extend 210 ft. above the foundation and will be 10 ft. in diameter inside. A railroad siding connecting with both the Pennsylvania and Reading Railroads will come into the yard running between the boiler room and the stack so as to facilitate the delivery of coal and the removal of ashes.

An interesting feature of the new plant will be the water supply tunnel. Plans have been drawn for, and work will shortly be started on, the boring of a 5-ft. tunnel in the solid rock 30 ft. below the surface of the ground, extending from the plant in a direct line under the yards of the Central Iron & Steel Company to the river. From the river bank a 36-ft. cast-iron pipe will extend nearly to the island, at which point in the river the best quality of boiler water is to be obtained. This water-supply tunnel will be built and used jointly by the Traction Company and the Central Iron & Steed Company.

All of the work is being carried out from plans prepared by and under the direction of Mason D. Pratt, consulting engineer, of Harrisburg, and W. C. Gotshall and C. O. Mailloux, of New York City, acting as advisory electrical engineers. The total cost of the plant will approximate $250,000.

DEATH OF CHARLES T. YERKES

Charles Tyson Yerkes, of the Underground Electric Railway Company, Ltd., of London, England, who has been sick in his apartment at the Waldorf-Astoria, New York, since coming to this country from London early in November, died on Friday afternoon, Dec. 29, at 1:30 o'clock. The end was not unexpected, and there were with him when he died Mrs. Yerkes, his son Charles T. Yerkes, Jr., and other members of the family. Mr. Yerkes suffered a serious decline early in the week, and his life was protracted only by heroic efforts on the part of his physicians.

C. T. YERKES

Mr. Yerkes is best known through his connection with the surface and elevated lines of Chicago, and the many changes which he effected in the traction systems of that city. He was born in Philadelphia on June 26, 1837. His career as a financier dated from 1859, when he started for himself as a stock broker. Soon thereafter he joined the Philadelphia Stock Exchange, and became one of the prominent dealers in State and municipal securities. In 1871, Mr. Yerkes succumbed to the panic following the Chicago fire, and was forced into bankruptcy. He retrieved these losses rapidly, however, and soon reaped a considerable fortune on the Exchange. His interests at this time were largely in Philadelphia railroad stocks. Again Mr. Yerkes suffered severe financial losses. Following this came a change in location by him that had its end in his settling in Chicago. From Philadelphia Mr. Yerkes went West as far as Fargo, N. D., where he engaged largely in real estate speculation. Chicago, however, offered larger possibilities, and Mr. Yerkes changed the base of his operations. Shortly after settling in Chicago he established a bank, and soon thereafter entered the Chicago traction field. Meanwhile he had married Miss Mary Adelaide Moore, of Philadelphia.

His entrance into the traction field in Chicago, which was in 1886, was marked by his purchase of the old North and West Chicago street railway systems. At that time horse cars were operated on the North and West Sides, but the South Side lines were operated by the cable system. The North and West Side lines comprised 64 miles of double track, with practically no cross-town lines and practically no system of transfers. There were no lines to the suburban districts and towns. Immediately, Mr. Yerkes began to unify the systems, install the cable on the principal lines and develop the suburban lines, with the result that after a few years there was a complete system of roads radiating from one central point, together with an extensive elevated system and a loop around the principal business district. From the original 64 miles of double track that came into his possession in 1886, he created a system of 297 miles of track and cross-town lines, 205 miles of suburban lines and 73 miles of single-track elevated lines.

Mr. Yerkes remained in Chicago fifteen years, or until 1901, when he disposed of his holdings in his surface lines to a syndicate of New York and Chicago bankers and capitalists, and to other investors of his stock in the elevated lines in Chicago. A recent visit to London had impressed him with the possibilities of the development of the transit facilities there, and he immediately prepared to enter actively that field. In London he formed the Metropolitan District Traction Company, Ltd., which was privately subscribed, and made plans for the building of some 140 miles of underground and surface tracks at an expenditure of at least $85,000,000. The systems which he succeeded in taking over and consolidating into the Underground Electric Railways Company, Ltd., were the Metropolitan District Railway, Metropolitan Railway, Great Northern, Piccadilly & Brompton Railway, Charing Cross, Euston & Hampstead Railway, Baker Street & Waterloo Railway. Later the system of surface lines of the London United Tramways was included. Extended reference to the projects of Mr. Yerkes in London are to be found in the Street Railway Journal of Nov. 21, 1903, and March 4, 1905.

At a special meeting of the Underground Electric Railway Company, of London, on Wednesday, Jan. 3, Edgar Speyer was unanimously chosen chairman, as successor to Charles T. Yerkes. Sir George Gibb, general manager of the Northeastern Railway, was elected deputy chairman and managing director. Sir George also becomes chairman and managing director of the District Railway. Robert William Perks will remain deputy chairman of the District Railway. Resolutions of regret at the death of Mr. Yerkes were passed.

Sir George Stegmann Gibb, LL. B., was born in Aberdeen, Scotland, April 30, 1850. He became assistant in the Great Western Railway Company solicitor's office in 1877, solicitor to the North Eastern Railway Company in 1882, and general manager in 1891. He was a member of the Royal Commission on London Traffic in 1903, and was a delegate to the International Railway Congress, held in Washington last spring. He was one of the first to introduce electric multiple-unit trains for the working of branch-line passenger traffic, and electrified a section of the Northeastern system near Newcastle.

SCRANTON RAILWAY SOLD

The American Railways Company has purchased the Scranton Railway Company. Both common and preferred stocks are taken over at par ($50) a share. The company is a consolidation of various street railways in and around Scranton. It has $1,500,000 of 5 per cent cumulative preferred and $2,000,000 of common stock. Dividends at the rate of 2½ per cent semi-annually began on the preferred stock in March, 1904.

E. W. Clark & Company, of Philadelphia, have sent the following notice to stockholders of the Scranton Railway: "We beg to advise you that we have entered into a contract to sell to the American Railways Company a controlling interest in the preferred and common stocks of the Scranton Railway Company, reserving in the contract of sale the right for all stockholders to participate in the sale on the same terms. Stockholders desiring to avail themselves of this offer should immediately deposit with us their common and preferred stock certificates, with the powers of attorney properly executed in blank, and we will deliver to them, in due course, the cash and new securities to which they are entitled under the terms of the sale, common stock, at par, $50 per share; $25 cash on Jan. 5, 1906; $25 cash on or before Dec. 15, 1906. The American Railways Company will give its notes, bearing 5 per cent interest per annum from Dec. 15, 1905, for the deferred payment, secured by the common purchased. We will hold these notes and said stock as collateral, and will issue our negotiable certificates of participation in the loan to the holders of common stock entitled thereto, reserving the right, however, to sell the notes at a price sufficient to pay the certificates of participation at par and accrued interest. Preferred stock, at par, $50 per share, payable in 5 per cent registered gold trust certificates issued by the New York Trust Company, of New York, under agreement with the American Railways Company, and secured by deposit with said trust company of preferred stock of the Scranton Railway Company, equal in par value to the certificates issued. These certificates will be dated Sept. 1, 1905, the date of the last preferred dividend, and will mature on Sept. 1, 1905, with the right of purchase at any semi-annual payment date after March 1, 1907, at the option of the American Railways Company, at 102½ per cent, together with semi-annual payments due thereon. The first semi-annual payment of $25 will be made on March 1, 1906. The certificates will be for $1,000 each, and scrip will be issued for fractions convertible into certificates when presented in amounts of $1,000 or multiples thereof. We shall be prepared to buy or sell scrip at 97½ per cent. A charge of $1 per share on the common stock will be made to cover legal and other expenses and commissions, and will be deducted from the cash payment of $25."

REPLY FROM PRESIDENT McCARTER

An article devoted to politics in Jersey City, from the pen of Lincoln Steffens, appears in the current issue of McClure's Magazine. In this article an attempt is made to connect President McCarter, of the Public Service Corporation, with using influence with his brother, the Attorney-General of the State, by which the latter declined to bring proceedings against the Corporation, as requested by Mayor Fagan, to terminate the franchise of one of the lines in Jersey City. The incidents related in the article were so largely overdrawn that the charges have fallen flat, and are still further discredited by a statement made last week by President McCarter. In this Mr. McCarter states that he had no conversation with his brother on the subject until after the failure of the proceedings. He also pointed out various legal defects in the bill advocated by Mayor Fagan, which were amply sufficient to warrant its failure at Trenton.

BINGHAMTON EMPLOYEES MAKE PRESENTATION TO THE PRESIDENT AND THE GENERAL MANAGER

G. Tracy Rogers, president of the Binghamton Railway Company, of Binghamton, N. Y., was presented with a gold-headed ebony cane, with monogram, and J. P. E. Clark, general manager, was presented by the employees with a gold watch made by Agassiz in Geneva, Switzerland, with monogram, on the afternoon of Sunday, Dec. 24. Each gift was accompanied with a pretty book with a list of the employees and with the following note of presentation: "Deeply appreciative of your kindness, we ask you to accept this gift as an evidence of our sincere esteem. We wish and earnestly hope that you may enjoy many merry Christmases and happy New Years." Mr. Rogers and Mr. Clark have been identified with the Binghamton Railway Company in an official capacity for sixteen years, and many of the employees included in the list of donors have been in the employ of the company for more than ten years. Their action speaks volumes for the pleasant relations existing between employer and employee.

One of the local papers in Binghamton, commenting editorially upon the feeling existing between the management and the employees as exemplified by the presentation, said:

"It seems to be possible for employers and employees to get along harmoniously. The discipline of the road is very strict, and any one caught at what endangers the public, the property of the company or its good reputation is bounced at the drop of the hat. All the employees understand that as well as the employers do. The employees have learned to like the strict discipline, for the reason that it is protection for them, and brings them in the company of all good men. The gentlemanly conduct of the conductors and motormen is the wonder of the traveling public. President Rogers and Manager Clark know exactly how to run a railroad. To gain the good will of the employees is a science worth knowing. Many such enterprises have failed through lack of such knowledge."

CLEVELAND ELECTRIC RAILWAY AFFAIRS

Directors of the Cleveland Electric Railway Company have declared a dividend of 1¼ per cent, payable Jan. 5, which places the stock on a 5 per cent basis instead of 4 per cent, as in the past.

The directors, as previously noted in the Street Railway Journal, have decided to allow the employees to share in the increased earnings of the company, and voluntarily announced an increase in pay of all employees. The new scale for motormen and conductors is 21 cents for first year, 22 cents for the second year, 23 cents for the third year, and thereafter 24 cents an hour. This was a most agreeable Christmas present to the men.

Charles Otis has retired as a director, and Samuel Mather has been elected in his place; otherwise the directors and officers remain as heretofore. It was announced that the gross earnings of the company this year will be $5,300,000, a gain of $550,000 over last year. Several new pleasure resorts and the opening of new lines were responsible for a considerable portion of the gain.

ACCIDENT FAKIRS CONVICTED IN NEW YORK

On Dec. 22, 1905, Recorder Goff, of New York, sentenced Isaac Bloom to State prison for seven years upon his conviction of the crime of perjury. Bloom brought an action against the Metropolitan Street Railway Company, claiming that he had been thrown while alighting from a car on Second Avenue on Dec. 9, 1901, and that he thereby received a shock which caused paralysis of one side of his body. Upon the trial of the case the attorneys for the Metropolitan Company proved that Bloom had been paralyzed a long time before the pretended accident, and that no such accident happened. The jury found a verdict against him, and he was thereupon arrested for perjury upon a warrant sworn out by James L. Quackenbush, the general attorney for the Metropolitan Company. It further appeared in the case that Bloom's attorney, Henry L. Slobodin, lived in the same house with him. Charges have been preferred against this attorney and are now pending before the Bar Association.

Bloom called as witnesses to the pretended accident three persons, who, it is said by the representatives of the Metropolitan, came from Albany to New York to attend the trial in a body. It is said that some of these witnesses will also be prosecuted.

On Oct. 17, 1905, Albert Woods and Mae Woods, his wife, were sentenced to terms of from three to five years in the State prison at Sing Sing, and from two to three years in the State prison at Auburn, respectively, by Judge Platt in the County Court of Westchester County upon their pleas of guilty to the indictment charging them with perjury in an action against one of the lines of the Metropolitan Street Railway system. The details of this case were given in the Street Railway Journal for Oct. 21, 1905.

RADIAL SCHEME FOR TORONTO

The plan of Mayor Urquhart, of Toronto, for providing entrances into the city for the radial railways has been presented to the board of control, and is being held over for further consideration and reports from the city engineer and city solicitor. The scheme proposes an agreement between the city and the Toronto Railway Company, including its subsidiary concerns, whereby two lines of cars to accommodate suburban traffic will enter the city, one from the northwest and one from the east. The terms of the present agreement are to govern the construction of the new lines, and the same amount of mileage, $800 for single and $1,600 for double track, is to be paid annually, in addition to the percentage on traffic, excepting on freight, which is not to be taxed for the city's benefit for a term of years.

The St. Lawrence Market is to be the terminal of both lines and the northwest route will start at the head of Christie Street and reach the market as follows: Christie Street to Bloor Street, a short turn to Clinton Street, to Mansfield Avenue, to Claremont Street, to Queen, to Niagara, to Bathurst, to Front, to the market. The eastern route will start at the Kingston Road, on Queen Street, to Eastern Avenue, to Trinity Street, to Front Street, to the market.

The Metropolitan tracks are to be removed from Yonge Street at Mount Pleasant Cemetery and diverted west by St. Clair Avenue to the city limits, and the present city line would be extended up Yonge Street to effect a junction.

The tracks of the new lines are to be standard gage, 4 ft. 8½ ins., the same as the tracks of the present radial lines, and where the route of the city line is encountered, a third rail is to be laid, as its gage is 4 ft. 10⅞ ins. wide. The agreement provides that the lines shall come into the city's possession at the expiration of the franchise of the Toronto Railway Company, in 1921, according to the terms of the present agreement. The company is to have the right to purchase station grounds and make all necessary connections, and the city will lend its aid in case any crossings of steam railways are found necessary, but the city engineer is to govern in all things and all costs are to be borne by the company. Any differences arising are to be settled by the county judge, with right to appeal only to the Court of Appeal for Ontario, and a refusal to obey an order of the court is to entail forfeiture of the franchise.

In addition to providing for suburban traffic, the Mayor also has a scheme for a new passenger line to relieve the present congestion. He proposes tracks from the market up Jarvis Street to Adelaide Street, then west to Bathurst Street and along to Farley Avenue and Niagara Street, connecting there with the radial system.

INCREASE IN WAGES IN MILWAUKEE

Motormen and conductors of the Milwaukee Electric Railway & Light Company, who have been in the employ of the company for ten years, will hereafter receive 23 cents an hour. The advance in wages by the company is entirely voluntarily, and comes to nearly 200 men affected as an agreeable New Year's surprise.

The following notice, posted in the various company car houses, informed the employees of the advance:

To the Milwaukee Electric Railway & Light Company Motormen and Conductors:

"Gentlemen:—Commencing Jan. 1, 1906, the pay of motormen and conductors who have been in our service, in that capacity, continuously for ten years (10) years or more, will be increased to twenty-three (23) cents per hour.

"This increase is voluntarily and cheerfully granted as an evidence and expression of our appreciation of intelligent, faithful and long-continued service, and as an assurance that those longest in our employ will always be given the greatest consideration possible.

"Appealing to every employee of the company to make constant and patient effort to merit the good will and good word of the public, I beg to remain, with the best wishes for your advancement and prosperity,

Yours sincerely,

"John I. Beggs,

"President and General Manager."

This is the second voluntary raise in wages announced by the company in several years. The men start in the employ of the company at 18 cents an hour. After two years of service they receive 19 cents, after three years 20 cents, after four years 21 cents, and after that 22 cents.

NORTHERN OHIO COMPANY OFFERS PRIZE FOR TRADE MARK

Realizing the desirability of having some distinctive emblem to characterize the property, stationery and general literature of the company, the Northern Ohio Traction & Light Company has decided to adopt an appropriate trade mark, and invites the public to assist in the selection of this trade mark. For the suggestion that is accepted the company will pay the sum of $50. Twenty-five dollars for the first prize, $15 for the second, $10 for the third prize.

To give some idea of what is desired in the way of a trade mark the company calls attention to the emblems and designs used by the railroad companies—such as the maple leaf, an artistic arrangement of names and initials and colored designs of animal heads or allegorical subjects. All suggestions must of course be in the form of drawings or sketches. The mediums shall be ink, wash or even oil. Pencil drawings will not be considered, and emphasis is laid upon the necessity of simplicity of design. The suggestion is to be used on all the company's property and must be sharply defined and comprehensive. Of what is practical suggestion can also be found in the trade marks of some of the largest manufacturing concerns, the letter heads of clubs and a few hotels. This is not a coat of arms, but a trade mark.

All designs must be submitted by Jan. 18. The decision and award of this competition will be made by the staff officers of the company, to which all designs must be mailed.

ALTON ORDERS MORE GASOLINE CARS

The success of the gasoline-electric motor car now being tested by the Chicago & Alton Railroad on its line between Jacksonville and St. Louis has induced the management to give an order for the construction of six more of these cars, to be used in the establishment of interurban service between local points on its line throughout the State of Illinois. It is the intention to divide up the line into sections of about 25 miles each, and furnish this local service over this territory. Alton officials claim that by the operation of these cars they can cut down the cost of operating passenger trains from about 30 cents a mile to less than 3 cents a mile. It will enable them to increase materially the service and furnish much more satisfactory accommodations.

PRESIDENT SULLIVAN OF BOSTON & NORTHERN ACQUAINTS PUBLIC WITH FACTS OF STREET RAILWAY OPERATION

President Sullivan of the Boston & Northern Street Railway system gave a smoke talk, recently, before the Chelsea Board of Trade, at Knights of Malta Hall, on street railway matters in general and Chelsea street railway matters in particular. Mr. Sullivan compared the possibilities of the Boston Elevated Railway, operating an urban system, and a company operating largely in the outlying districts, like the Boston & Northern road. The Elevated, for example, has an average population of 2300 for each mile of track it operates. The Boston & Northern has an average of only 1100 per mile. The Elevated has an average income of $30,000 per mile of trackage, while the Boston & Northern has an average income of only $7,300 per mile of track. The average income per mile for street railroads in Massachusetts is $10,000, with the elevated trackage included.

President Sullivan surprised his auditors by saying the road's Revere Beach business was actually a handicap to it. "People see the heavy traffic to the beach in midsummer," he said, "and it appears to the onlooker that the road is 'coining money.' The capital invested is there 365 days in the year, but yields the company an income for only 20 days each year. In the old days, when the company operated by horse cars, we sold our horses at the end of the summer. Now the entire investment has to be retained during the 12 months."

In conclusion, Mr. Sullivan declared that it was his belief that street railroad companies in Massachusetts are at this time approaching a critical period. "They made large investments," he explained, "when the cost of operation was much lower than it is now. Since the time of those investments the price of rails has advanced from $19 to $27; there has been an increase of 40 per cent in the price of copper, an increase of from 25 to 30 per cent in the cost of cars; an increase of 50 per cent in the cost of motors, and other necessities for railroad operation have increased in proportion. I have seen the time when 1 cent was considered a good profit in street railroad operation, but now the stockholders are pleased to secure a profit of 6 mills."

MEETING OF THE CLEVELAND ELECTRIC CLUB

The Electric Club, of Cleveland, Ohio, had a "smoker" on the evening of Dec. 15, which was thoroughly enjoyed by a large number of members and their friends. The announcement stated that the meeting would be addressed by Charles F. Brush and Professor Elihu Thomson, and a number attended with expectation of seeing those gentlemen. As a matter of fact, the addresses were delivered via a phonograph, and at the same time that the phonograph was in operation, the portraits of the speakers were thrown on the screen.

In order to carry out the idea consistently, E. P. Roberts, president of the club, introduced the speakers via phonograph, and at the end of the introductory remarks called for a vote of thanks, and requested all of those in favor to say aye; and at the same time the record was being made, a number of men took part in the vote, and same was fully endorsed and strengthened by the shouts of those present when the record was used.

THE ANNUAL MEETING OF THE INDIANA ELECTRIC RAILWAY ASSOCIATION—INDIANA-OHIO CONFERENCE

The annual meeting of the Indiana Electric Railway Association will be held in Indianapolis on Monday, Jan. 11. The programme will consist of the annual address of President C. L. Henry, and the informal discussion of miscellaneous subjects. The question box is expected to afford some good subjects for discussion. The meeting will close with a dinner at the Claypool.

On Jan. 10, a committee from the Ohio Electric Railway Association will confer with a like committee from the Indiana association with a view to the amalgamation of the two associations. The plans in contemplation provide that the new association shall be known as the Central States Interurban Association. A salaried secretary is to be employed with headquarters in Columbus or Indianapolis.

UTICA & MOHAWK EMPLOYEES GET INCREASE

An increase in salary of two cents an hour has been voluntarily given the employees of the Utica & Mohawk Valley Railway. News of the increase was conveyed to the men in a letter from General Manager C. Loomis Allen, which was dated Dec. 25. This letter follows:

Utica & Mohawk Valley Railway Company.
Utica, N. Y., Dec. 25, 1905.

Dear Sir.—During our holiday season we frequently hear expressions of good cheer and well wishes for our happiness and prosperity. It is altogether fitting that one's good feelings should not alone be expressed in words, but in a more substantial and practical manner, and it gives me great pleasure to announce to you in behalf of the officers and directors of the Utica & Mohawk Valley Railway Company, that an increase in your rate of pay will be effective on Christmas morning, Dec. 25, 1905.

The rate of wages after that date will be as follows:

Motormen and conductors during their first year's service will receive 18 cents per hour, and for service rendered after the first year 20 cents per hour.

Motormen and conductors running on the interurban lines will receive 22 cents per hour.

The date of your entrance into the service of this company is ———, and your run is on the ——— division. You are therefore entitled to receive ——— per hour.

Wishing you a Merry Christmas and a Happy New Year, I am,
Yours very truly,
C. Loomis Allen, General Manager.

The average run is 10½ hours a day and there are seven working days in each week. There are about 300 conductors and motormen in the employ of the company, including regular and extra men, to all of whom the advance applies. The car starters, despatchers, men on the corners, the office clerical force and others were also given an increase in pay. To those who did not get an increase, $10 gold pieces were handed out by General Manager Allen. The men on the old Herkimer and the Oneida branches also share in the increase. The company calculates that the raise will cost about $18,000 a year, and if the force is increased, it will go above this figure. The schedule in force previous to the increase was 16 cents an hour for the first year, 18 cents an hour thereafter on the urban lines, and 20 cents an hour on the suburban or through lines.

NEWARK-NEW YORK HIGH SPEED LINE

It is stated that the project for one of the two proposed high-speed electric railways between Newark and New York is to be abandoned and that but one road will be constructed, to be controlled and operated by allied interests—the Pennsylvania Railroad, the Belmont-Ryan syndicate and the McAdoo tunnel promoters.

Within the last month public announcements were made of the plans of the Public Service Corporation in alliance with the Ryan syndicate and of William G. McAdoo, the Belmont syndicate and the Pennsylvania Railroad of new roads to be constructed. The Public Service proposed to establish its Newark terminal in Park Place, near East Park Street, while the McAdoo plans called for a subway with a loop around the Newark Court House to run under Market Street to Railroad Avenue, thence along the right of way of the Pennsylvania Railroad to the Passaic River, which was to be crossed by tunnel. Both plans were similar in that the roads were to be mostly underground.

According to the latest announcement, the line projected by the Public Service Corporation has been selected. It will extend underground from the Park Place terminal in Newark to the Passaic, cross that river by tunnel and continue over a private right of way through Harrison and Kearny to the Hackensack. In Jersey City the line will be partly underground and partly elevated, with some parts, owing to the peculiar topographical conditions, on the surface.

The McAdoo tunnels are to be utilized to carry the road under the Hudson to Manhattan, where it will reach four different points. It will connect with the surface railroads in Newark and Jersey City, and in New York connections will be established, according to the report, with the subway and surface lines, the Pennsylvania's main line to Long Island, and with the New England railroad systems.

It is said that the new plan has received the full approval of both the Belmont and Ryan interests, and that most of the details of the argreement have been perfected.

MR. VREELAND TO REMAIN IN NEW YORK

Following the death of Charles T. Yerkes there were persistent rumors that H. H. Vreeland, president of the New York City Railway Company, had received a flattering offer from the banking interests in control of the London Underground Railways, to take up the work left by Mr. Yerkes, and that he had decided to accept the offer and go to London. It is known that several years before his death Mr. Yerkes tendered Mr. Vreeland an offer to take charge of the operation of his London roads, but this offer was declined. The rumor that Mr. Vreeland would go to London on this occasion was set at rest Jan. 3 by the announcement of the appointments, referred to elsewhere, of Edgar Speyer, of Speyer & Company, to take charge of the general financial interests of the company, and of Sir George S. Gibb of its technical operation.

Although the plans of the new company in New York have not yet been announced, it is stated, on good authority, that Mr. Vreeland will remain at the head of the Metropolitan Street Railway system. The consolidation effected last week between the Metropolitan Street Railway and the Interborough Rapid Transit interests was one which it is thought will not materially affect either operating organization. Certain improvements and economies will be effected by the consolidation, which will undoubtedly be to the advantage of the traveling public, as well as to the stockholders of both companies. It will not, however, according to those conversant with the situation, make any material change in the holdings of the interests concerned, and is, in reality, a merger of two large corporations and interests, rather than a transfer of stock from one interest to another.

The directors of the Metropolitan Securities Company have issued a call of $25 a share on the company's stock, payable on or before Jan. 30. So far, 50 per cent has been paid, and this additional call will make the stock 75 per cent paid. This step is taken in accordance with the plan for the consolidation of the Metropolitan Securities Company and the Metropolitan Street Railway Company with the Interborough Rapid Transit Company. The payment is to be made at the Morton Trust Company. As a result of its guarantee of 7 per cent dividends on the stock of the Metropolitan Street Railway Company, the Metropolitan Securities Company has run up a large debit in its profit and loss account. The call for $25 a share, it is understood, is for the purpose of settling this account in anticipation of the merger of the two traction systems. Counsel for the Metropolitan and Interborough interests are still at work on the details of the merger. They are engaged at present in the preparation of the necessary legal papers. It is said that this work will probably be completed early in January.

PERSONAL MENTION

MR. J. B. CRAWFORD has just been appointed superintendent of the Groton & Stonington Street Railway, with headquarters at Mystic, Conn.

MR. L. B. STILLWELL and MR. JOHN VAN VLECK have removed their electrical and general engineering offices to 100 Broadway, New York.

MR. HUGH WILLIAM ROSS, assistant superintendent of transportation for the Utica & Mohawk Valley Railway Company, of Utica, N. Y. is dead.

MR. JOHN LORENZ, who for the past three years has been general manager of the combined railway, light and gas properties of the Jackson Electric Railway, Light & Power Company, at Jackson, Miss., is retiring from the management of the company to become president of the Jackson, Clinton & Western Traction Company, which proposes to build an interurban line from Jackson to Clinton, a distance of 10 miles. The line is to be built on private right of way, and will carry express and baggage.

MR. SAMUEL RIDDLE has been appointed superintendent of transportation of the Rhode Island Company, to succeed Mr. A. E Potter, who has been elected general manager of the company in place of Mr. R. I. Todd, resigned, who has become general manager of the Indianapolis Traction & Terminal Company. Mr. Riddle was born in Glen Ridge, Pa., 1878, and graduated from Swarthmore College in 1897. From that time till 1904 he was connected with various engineering companies. Since 1904 he has been with the Rhode Island Company familiarizing himself with the various departments. Last year was spent by him in the transportation department, the duties of which will now devolve upon him as superintendent of transportation.

MR. A. E. POTTER, superintendent of transportation of the Rhode Island Company, of Providence, R. I., has been appointed general manager of the company, to succeed Mr. R. I. Todd, who, as previously noted in the Street Railway Journal, has become general manager of the Indianapolis Traction & Terminal Company. Mr. Potter is a native of Providence, and is 33 years of age. He entered the employ of the Union Railway Company, out of which grew the Rhode Island Company, in 1892, as assistant to the superintendent of tracks. He served in this capacity until 1895, when he was appointed assistant chief conductor. In 1897 Mr. Potter was appointed superintendent of transportation, the duties of which office he was subsequently elected to perform after the Union Company was absorbed by the Rhode Island Company in 1902.

MR. JOHN W. LIEB, JR., at a meeting of the board of directors of the American Institute of Electrical Engineers on Dec. 15, was appointed trustee to represent the institute for a term of three years upon the board of trustees of the United Engineering Society, invested with the care and administration of the new United Engineering Building. Mr. Lieb at the same time was made a representative of the institute on the building committee. He succeeds Dr. Schuyler Skaats Wheeler, who by reason of his recent election to the presidency of the institute resigns from these other bodies. The representation of the institute, therefore, after the annual meeting of the United Engineering Society in January, will consist of Messrs. Charles F. Scott, Bion J. Arnold and John W. Lieb, Jr., who are past presidents of the institute in the order named. Work on the building is in active progress.

MR. HENRY C. EBERT, assistant to the third vice-president of the Westinghouse Electric & Manufacturing Company, has resigned his position to become the president of the Cincinnati Car Company and vice-president of the Ohio Traction Company. Mr. Ebert's connection with the Westinghouse Electric & Manufacturing Company dates back about fifteen years. After having been promoted to the position of superintendent of construction, which he occupied for some years, he was made chief of the correspondence department, later assistant to the manager of works, and lastly assistant to the third vice-president. It was while Mr. Ebert occupied the position of superintendent of construction that the ten 5000-hp revolving field generators made by the Westinghouse Company were installed and put in operation in the power plant of the Niagara Falls Power Company. The officers of the Westinghouse Electric & Manufacturing Company gave a dinner in his honor at the Hotel Schenley just before he left, and as a token of the esteem in which he had been held during his long association with the company, he was presented with a beautiful bronze electric stand lamp

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O. Northern Ohio Tr. & Light Co	1 m., Nov. '05	77,111	43,331	33,780	23,067	10,713
	1 " " '04	71,388	38,920	32,468	23,024	9,444
	11 " " '05	878,202	471,238	406,965	253,337	153,629
	11 " " '04	819,115	445,442	373,673	249,152	124,521
AURORA, ILL. Elgin, Aurora & Southern Tr. Co	1 m., Oct. '05	42,375	22,976	19,399	9,333	10,065
	1 " " '04	37,947	22,040	15,906	9,333	6,573
	4 " " '05	183,169	93,482	89,687	37,173	52,514
	4 " " '04	165,206	85,928	79,278	37,173	42,105
BINGHAMTON, N. Y. Binghamton Ry. Co.	1 m., Nov. '05	20,489	11,947	8,541	7,282	1,260
	1 " " '04	18,434	10,695	7,740	7,036	704
	5 " " '05	131,072	63,926	67,146	36,128	31,018
	5 " " '04	116,682	59,458	57,224	34,844	22,380
CHICAGO, ILL. Aurora, Elgin & Chicago Ry. Co	1 m., Oct. '05	58 573	30,930	27,643	......	......
	1 " " '04	42,713	21,202	21,511	......	......
	4 " " '05	268,547	128,604	139,943	......	......
	4 " " '04	201,570	97,330	104,239	......	......
Chicago & Milwaukee Elec. R. R. Co	1 m., Nov. '05	54,400	24,480	29,920	......	......
	1 " " '04	45,326	17,961	27,365	......	......
	11 " " '05	528,291	220,353	307,938	......	......
	11 " " '04	425,228	161,518	263,711	......	......
CLEVELAND, O. Cleveland, Painesville & Eastern R.R. Co	1 m., Nov. '05	18,057	* 11,931	6,127	6,658	† 531
	1 " " '04	16,710	* 11,327	5,383	6,638	† 1,255
	11 " " '05	225,248	*131,126	94,121	74,031	20,090
	11 " " '04	208,658	*125,329	83,329	73,612	9,717
Cleveland & Southwestern Traction Co.	1 m., Nov. '05	46,254	25,900	20,354	......	......
	1 " " '04	41,048	22,892	18,156	......	......
	11 " " '05	495,687	287,706	207,981	......	......
	11 " " '04	438,291	271,181	167,110	......	......
DETROIT, MICH. Detroit United Ry.	1 m., Nov. '05	419,299	*247,426	171,873	93,023	78,850
	1 " " '04	372,534	*212,611	159,923	90,511	69,412
	11 " " '05	4,725,292	*2798901	1,926,391	1,014,597	911,794
	11 " " '04	4,191,824	*2524402	1,667,422	982,167	685,255
DULUTH, MINN. Duluth St. Ry. Co	1 m., Nov. '05	55,154	30,597	24,556	18,171	6,385
	1 " " '04	51,925	25 553	26,372	16,521	9,851
	11 " " '05	602,333	311,906	290,427	188,349	102,078
	11 " " '04	565,461	297,931	267,530	181,505	86,025
EAST ST. LOUIS, ILL. East St. Louis & Suburban Co	1 m., Nov. '05	118,218	54,670	63,548	......	......
	1 " " 04	129,821	47,890	81,931	......	......
	11 " " '05	1,223,065	539,758	683,307	......	......
	11 " " '04	1,248,146	550,507	697,639	......	......
FT. WAYNE, IND. Ft. Wayne & Wabash Valley Tr. Co.	1 m., Oct. '05	80,993	48,625	32,367	......	......
	1 " " '04	71,884	43,774	28,110	......	......
	10 " " '05	781,697	483,577	298,120	......	......
	10 " " '04	694,862	444,347	250,515	......	......
GALVESTON, TEX. Galveston Electric Co.	1 m., Oct. '05	23,929	15,039	8,890	4,167	4,723
	1 " " '04	22,274	......	......	......	......
	6 " " '05	149,471	89,563	59,908	25,000	34,908
	6 " " '04	142,054	......	......	......	......
HANCOCK, MICH. Houghton County St. Ry. Co	1 m., Oct. '05	16,540	11,422	5,118	3,753	1,365
	1 " " '04	17,965	10,821	7,144	3,561	3,583
	12 " " '05	168,770	169,712	† 942	42,780	† 43,722
	12 " " '04	194,592	133,538	61,053	39,312	21,741
HOUSTON, TEX. Houston Electric Co.	1 m., Oct. '05	46,324	27,166	19,158	9,015	10,143
	1 " " '04	38,639	21,680	16,959	8,277	8,682
	12 " " '05	499,754	299,885	199,870	104,260	95,610
	12 " " '04	336,537	315,441	21,096	96,002	† 74,905
JACKSONVILLE, FLA. Jacksonville Elec. Co.	1 m., Oct. '05	25,797	15,542	10,255	3,380	6,875
	1 " " '04	29,359	19,957	9,402	3,017	6,385
	10 " " '05	259,595	150,559	109,036	31,140	77,896
	10 " " '04	240,680	147,236	93,445	30,766	62,679
MILWAUKEE, WIS. Milwaukee El. Ry. & Lt. Co.	1 m., Nov. '05	278,458	127,494	150,964	78,712	72,252
	1 " " '04	275,590	132,844	142,746	77,654	65,092
	11 " " '05	2,947,791	1,412,899	1,534 892	847,930	686,962
	11 " " '04	2,932,071	1,456,150	1,475,920	834,388	641,532
Milwaukee Lt., Ht. & Tr. Co	1 m., Nov. '05	45 962	18,856	27,106	22,409	4,697
	1 " " '04	36,524	16,821	19,703	17,766	1,938
	11 " " '05	560,664	232,996	327,668	232,506	95,132
	11 " " '04	423,986	199,862	224,124	185,782	38,342
MINNEAPOLIS, MINN. Twin City R. T. Co	1 m., Oct. '05	420,981	192,938	228,043	103,208	124,835
	1 " " '04	368,057	170,238	197,819	97,308	100,511
	10 " " '05	3,903,669	1,771,088	2,132,581	1,000,217	1,132,364
	10 " " '04	3,576,229	1,680,406	1,895,823	914,441	981,382
MONTREAL, CAN. Montreal St. Ry. Co.	1 m., Nov. '05	232,635	153,628	79,008	22,074	56,933
	1 " " '04	204,555	133 849	70,706	18,871	51,835
	2 " " '05	482,424	295,309	187,115	43,137	143,978
	2 " " '04	426,831	255,486	171,345	37,818	133,527
OAKLAND, CAL. Oakland Traction Consolidated	1 m., Oct. '05	128,753	64,958	63,794	34,193	29,601
	1 " " '04	38,162	15,993	22,169	10,692	11,478
	10 " " '05	1,185,965	608,651	577,314	323,319	253,994
	10 " " '04	1,037,917	542,588	495,329	265,499	229,830
San Francisco, Oakland & San Jose Ry. Co.	1 m., Oct. '05	47,083	21,891	25,192	13,425	11,767
	1 " " '04	38,162	15,993	22,169	10,692	11,478
	10 " " '05	439,142	193,248	245,893	132,990	112,904
	10 " " '04	336,122	147,364	188,758	88,332	100,426
OLEAN, N. Y. Olean St. Ry. Co	1 m., Oct. '05	10,440	5,584	4,856	2,570	2,285
	1 " " '04	10,206	4,839	5,367	2,631	2,736
	4 " " '05	48,600	23,360	25,240	10,728	14,512
	4 " " '04	43,047	20,995	22,052	10,525	11,527
PEEKSKILL, N. Y. Peekskill Lighting & R R. Co.	1 m., Oct. '05	10,588	* 5,483	5,105	......	......
	1 " " '04	9,656			......	......
	4 " " '05	46,533	* 23,171	23,363	......	......
	4 " " '04	42,772	......	......	......	......
PHILADELPHIA, PA. American Rys. Co.	1 m., Nov. '05	120,700	......	......	......	......
	1 " " '04	105,754	......	......	......	......
	5 " " '05	718,433	......	......	......	......
	5 " " '04	636,187	......	......	......	......
ROCHESTER, N. Y. Rochester Ry. Co.	1 m., Nov. '05	149,188	99,728	49,460	28,815	20,645
	1 " " '04	119,288	69,982	49,306	26,890	22,416
	11 " " '05	1,619,953	877,115	742,839	306,135	436,704
	11 " " '04	1,357,495	748,955	608,539	293,136	315,402
SAN FRANCISCO, CAL. United Railroads of San Francisco.	1 m., Oct. '05	638,319	......	......	......	......
	1 " " '04	595,445	......	......	......	......
	10 " " '05	5,825,662	......	......	......	......
	10 " " '04	5,507,439	......	......	......	......
SAVANNAH, GA. Savannah Electric Co.	1 m., Oct. '05	49,907	31,752	18,155	10,642	7,513
	1 " " '04	48,171	26,814	21,358	10,694	10,664
	12 " " '05	575,758	341,322	234,436	126,739	107,697
	12 " " '04	540,053	304,291	235,762	125,924	109,839
SEATTLE, WASH. Seattle Electric Co.	1 m., Oct. '05	232,827	148,201	84,626	23,848	60,778
	1 " " '04	203,232	136,195	67,037	25,411	41,626
	12 " " '05	2,511,607	1,669,121	842,486	295,888	546,598
	12 " " 04	2,283,516	1,580,506	703,011	284,399	418,612
TERRE HAUTE, IND. Terre Haute Tr. & Lt. Co	1 m., Oct. '05	57,336	37,813	19,523	10 430	9,093
	1 " " '04	47,405	30,128	17,277	9,319	7,958
	12 " " '05	614,617	402,638	211,980	119,445	92,535
	12 " " '04	555,065	369,129	185,937	113,459	72,478
TOLEDO, O. Toledo Rys. & Lt. Co.	1 m., Oct. '05	165,511	* 82,256	83,255	42,826	40,429
	1 " " '04	150,196	* 76,183	74,013	41,251	32,762
	10 " " '05	1,573,293	* 801,906	771,387	425,020	346,367
	10 " " '04	1,440,144	* 768,335	671,809	416,555	255,254
YOUNGSTOWN, O. Youngstown-Sharon Ry. & Lt. Co	1 m., Oct. '05	46,804	* 24,288	22,016	......	......
	1 " " '04	39,109	* 23,601	15,508	......	......
	10 " " '05	441,851	* 236,383	205,468	......	......
	10 " " '04	379,208	* 229,935	149,273	......	......

Street Railway Journal

Vol. XXVII. NEW YORK, SATURDAY, JANUARY 13, 1906. No. 2.

Published Every Saturday by the

McGraw Publishing Company

Main Office:
NEW YORK, Engineering Building, 114 Liberty Street.
Branch Offices:
Chicago: Monadnock Block.
Philadelphia: Real Estate Trust Building.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York"; "Stryjourn, London"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada, Mexico and the Canal Zone.

Street Railway Journal (52 issues)............................$3.00 per annum
Single copies ....10 cents
Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August and November) $4.00 per annum
Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy)..........................$6.50 per annum

To All Countries Other Than Those Mentioned Above:
Street Railway Journal (52 issues), postage prepaid..................... $6.00
25 shillings. 25 marks. 31 francs.
Single copies..20 cents
Remittances for foreign subscriptions may be made through our European office.

NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the Street Railway Journal.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires.

Of this issue of the Street Railway Journal 8000 copies are printed. The total circulation for the year 1905 was 424,350 copies, an average of 8160 copies per week.

The Tendency Toward Centralization

One of the characteristic features of industrial development during the past four years has been the centralization of authority and control of distant properties, and it is not surprising that many street railway companies in the country should come under this influence. Although these consolidations of interests have occurred in the street railway field for some years past, they have notably increased during the past year, and, on account of the many advantages secured, will undoubtedly continue as an economic force. We have referred to some of the advantages of such a change in organization, and we are glad to publish in this issue an article by William Pestell, who sounds a note of warning as to one danger which should be guarded against. In the economies which flow from a centralized organization, sight should not be lost of the local representative, and if his authority should be so reduced that he loses his ability to take the initiative or forfeits the confidence of the public that he is in a position to rectify troubles, or is out of touch with the general policy of the company, his value is greatly diminished. We referred last week to the importance of looking after the man with the nickel, and we feel it is equally important for a centralized management either to keep in close touch with the local situation, which can only be done by close attention to details, or else to get a good superintendent and then give him a wide latitude in handling the local situation. If this is not done there is great danger of nullifying many of the advantages gained by consolidation.

Lighting Machine Tools

Although articles and comments have appeared from time to time on shop lighting, very little has been said specifically on the lighting of separate machine tools. Many shops could make much-needed improvements if attention were given to this important detail, as there are very few shops that do not have machines installed in dark corners, and at this season of the year in all shops artificial light must be depended upon entirely for a period of about two hours each day. In some shops about the only provision for lighting machine tools is to suspend a 16-cp lamp over the machine. No shade is provided, and there is nothing to prevent the lamp swinging from side to side. As the suspending cord is usually very long, the lamp is swinging most of the time.

It is demanding too much of a workman to require him to do accurate work under such a light. No matter how hard he tries, he is likely to make errors, the cost of which will many times pay for the installation of lights in the proper manner. Even if no errors are made, it is a costly plan to fail properly to light machines. A man can never work as fast when he is compelled to feel rather than see what he is doing, and the slow rate at which work is turned out with inadequate lighting is in itself a sufficient incentive to better the arrangements. Then, again, the workman, after he has made a few mistakes in setting his tool and has reached the point of exasperation, loses pride in his work, and when this happens, both the management and the workman are the losers.

Lights for machine tools should be placed on brackets or stands in such a manner that they are held rigidly. The support should be provided with adjustable arms, so that the lamp may be set down close to the work. Such stands or brackets may be easily constructed in the machine shop, and the cost of the material will be practically nothing. By all means, the lamps should be provided with shades of some sort. Sometimes large shades are not permissible, as they prevent placing the lamp as near the work as desirable. But there is a sufficient number of shapes and types of shades on the market to permit of a selection of a style most suitable to each machine.

Often, however, one lamp, even if it be a 32-cp one, is not sufficient to properly light a machine. If so, the cost of current for extra lamps should not be reckoned, and especially so in a street railway shop, where the current usually costs about .3 cent per kw-hour. Assuming this rate, a lamp-hour costs about .015 cent. At this cost, it is a rather safe risk to install all the lamps which have the least possibility of being used.

It isn't necessary to employ an illuminating engineer to place lamps properly about a shop. All that is required is to give the workmen to understand that the lamps will be fixed for them as they may desire. If such a hint were given them and their wishes were then followed, in many shops much more satisfactory machine work would be turned out, and it would be executed much more rapidly.

Inspecting Armatures for Clearance

It seems rather strange that so many armatures should be burned out because of their dropping down on the pole pieces. This occurs even in those shops where motors are supposed to be inspected every day or two. If bearings were of such a nature that they wore down suddenly, there might be some excuse for armatures dropping down. But this is not the case. The bearings, of course, wear gradually. About the only reason that can be attributed to the condition of things is that those responsible for the inspection of clearances do not do their duty properly. To properly inspect an armature for clearance, both hand-hole covers should be removed. These are usually fastened in position with cap screws, and to remove the covers and replace them quite a little time is required. The motor inspector most probably doesn't see the necessity of going to all the trouble of removing the covers simply to look at an armature, which ninety-nine cases out of a hundred will be all right, so without removing the hand-hole covers he puts "clearance O. K." on the inspection card, and trusts to luck that everything is all right.

Since we cannot improve on the inspectors, it might be well to make the inspection of the motors a little less difficult. This could be done by hinging the hand-hole covers and providing them with a suitable latch. The latch, of course, would necessarily be of such a design that the cover could not become unfastened and swing down when the car was in service. However, we see no mechanical reason why the cover could not be hinged and fastened satisfactorily. If this change were made on motors, we do not doubt that the cases of armatures being grounded on the pole piece would be very much less frequent than at the present time.

Single vs. Double-End Interurban Cars

The discussion on cars for interurban service at the recent Indiana convention, naturally brought up the question of building cars to be operated in one direction only. The idea of building them to operate always in one direction seems to be gaining ground. Of course, there are roads where local conditions render it impossible to put in Y's or loops at the terminals, and in such instances single-end operation is out of the question. There has also been recently considerable discussion as to the proper location of toilet and smoking compartments on interurban cars, whether in the forward or the rear portion of the car. If there are any peculiar advantages of either location these are lost when the car is operated in both directions, and the fact that the location of these compartments is worthy of consideration is seen to be a point in favor of single-end cars. Strongest car construction favors single-end operation only. When so constructed there is no necessity of building the front platform to drop below the car-body floor. Constructing the platform on the same level as the floor of the car body not only reduces the cost but it also gives it a much stronger and more solid bottom framing than can be otherwise obtained, as the longitudinal sills may be extended clear through to the bumper. This construction, moreover, facilitates the design of the draft rigging. We see no reason why the overhang on the front end could not be reduced also. In cars where the platform is dropped on one end only it is the usual custom to make the overhang the same on both ends, but we see nothing to prevent the front trucks being placed forward as far as permissible, irrespective of the position of the rear one. The appearance is about the only reason that can be urged against the adoption of this practice.

At the Indiana convention a point brought up in favor of cars equipped for operation from one end only, was that the maintenance costs were less. So far as the electrical equipment is concerned we hardly believe the increased expense of maintenance of a car equipped on both ends is sufficient to have a deciding influence. The only addition to be made is the lengthening of the cables and the addition of a controller and a trolley pole. When two controllers are used on a car, each is subjected to but one-half the wear that one would get, so the cost of maintenance is about the same. This also applies as well to the use of two trolley poles. But there are brake rigging, sanding devices, headlights, marker lights, pilots and many other parts, all of which when double equipments are used on each car contribute to add to the total expense of maintenance. About the only argument that can be urged against running cars in one direction is that the loops and Y's at the terminals cost considerable. So far as the time required to turn the cars on these loops and Y's is concerned, this may be neglected, since it is about offset by the time usually taken by the motorman and the conductor in changing the headlight from one end of the car to the other, and possibly the fender also, changing the trolley poles, and carrying personal effects from one vestibule to the other.

Training for Emergency Stops

Instinct or habit constitutes a considerable factor in the make-up of every person. Although human beings are rational in a great many actions, it is a characteristic of the race that if they acquire or fall into a certain habit under a given set of conditions, they will repeat the same actions involuntarily when those conditions are repeated; in fact, the tendency so to act will be more rapid than the brain can work in logically analyzing the problem. This faculty, we believe, could be taken advantage of more than it is in the training of motormen to make emergency stops. If a prospective motorman were put to work making emergency stops until he would involuntarily make them on the mere indication of danger, we believe some serious accidents would be avoided.

An incident within the writer's experience has impressed upon him the idea that more could be done toward training motormen to this end. While riding in the motorman's cab of a heavy city car, a large ice wagon backed over the track just ahead. The motorman had evidently been told the proper course under the circumstances, and probably knew what should be done if given a few minutes to think about it, but at any rate, he began tugging at the reverse handle, first with one hand and then with both. The handle, of course, would not move, as the power had not been first shut off. The writer's wits came to him suddenly, and, reaching beyond the motorman, he threw the controller handle to the "off" position, after which the car was stopped, but not before the wagon had been given a smart jolt. After the stop had been made, the motorman gave the usual excuse for such incidents. That is, when asked, he informed the conductor that "the brakes refused to work."

But the point of the incident is that had that motorman spent a few hours in actually making emergency stops, and in trying to make them in as short a time as possible, no doubt he would have first involuntarily thrown off the power before attempting to pull the reverse lever. It is possibly the practice of some roads to give a great deal of attention to this part of a motorman's training, but we know that such schooling is neglected on many roads.

Of course, it would hardly be advisable to encourage or to permit motormen to practice making such emergency stops on cars in service when at the end of the line they have a little spare time. Such practice should be carried out on a car on which less damage to the body and equipment would result. In fact, on some roads, the tendency of motormen to take emergency measures too frequently in ordinary service without any occasion has had to be repressed.

Hand Versus Automatic Stoking

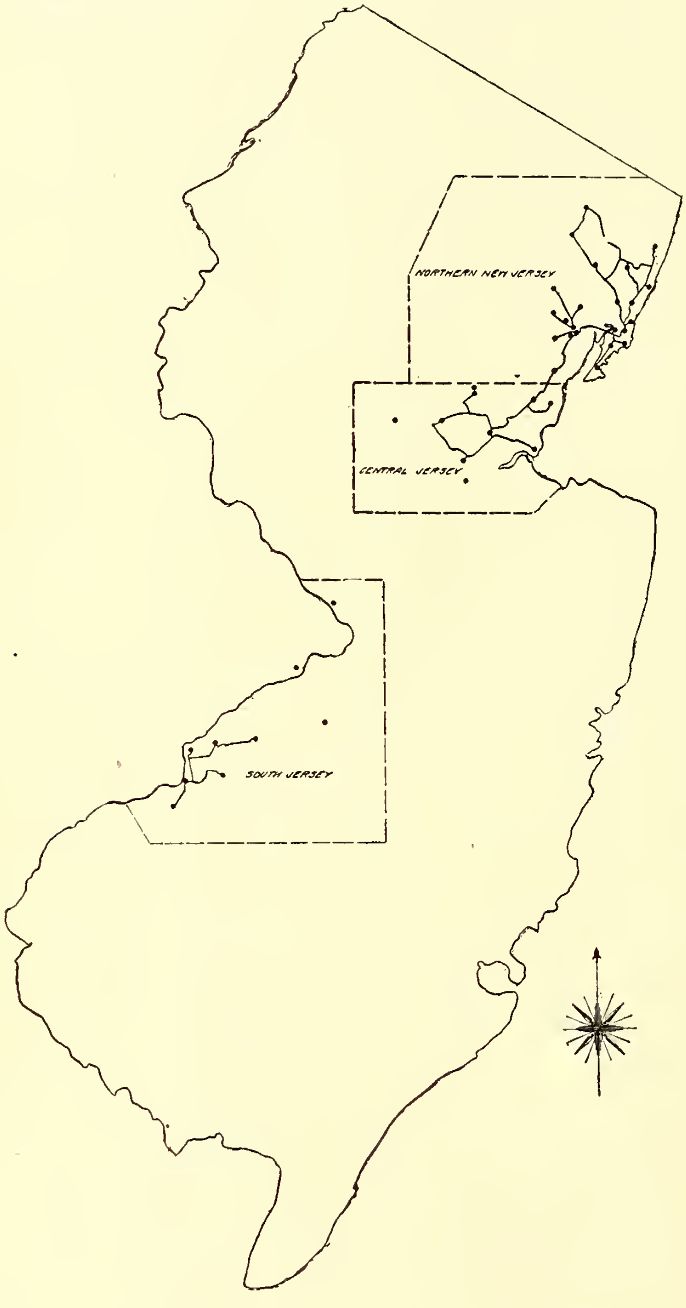
This topic is one that is steadily at the front, both here and abroad. It is brought again to mind just now by some discussion in England involving the results of a series of competitive tests. The use of mechanical stokers is steadily on the increase, responsive to that general tendency toward the replacement of human labor by machinery. It seems just as natural to substitute an automatic stoker for firemen as it does to use a steam shovel and conveyor for making a railway cut. Yet there is this difference between the two things: that the former is intended to replace intelligent labor, while the latter replaces labor of a singularly low grade. There are distinctions even in rough labor, as witness the foreman of a street sweeping gang, who, in answer to an inquiry as to the capability of one of his charges, responded: "Yes, Rafferty is a good man, but he's no artist; he can't sweep around a post." So there is no denying that firing is a fine art as compared with ditch digging, and the machine that does it has a careful task before it. The practical question is whether mechanical stoking can regularly be depended upon to fire a boiler more economically than it can be fired by manual labor. It is not merely necessary that the machine should raise a little more steam per pound of coal; it must do it at a lower total cost, including repairs and depreciation, and with at least equal reliability.

The English comparative tests to which we refer were conducted in various industrial establishments, and with various kinds of boilers and coal. Using low-grade coal, the gains shown by mechanical stoking were most conspicuous, the evaporation per pound of coal reaching in one case an increase of more than 30 per cent. This is quite in accordance with the general trend of results here. In using poor coal, the relative cost of firing is increased, since much more coal has to be handled and more ash has to be disposed of. More than this, the poor fuel demands more attention, the fire doors are oftener open, and good economical results demand a care on the part of the fireman seldom attainable. As the fuel improves in quality, the cost of hand firing diminishes, and it is quite possible that a point may be reached at which the general and labor charges on the automatic stoker more than balances any savings by its use. It is very dangerous to argue from one plan to another, on account of wide differences in load conditions, but it is a curious fact that in the reports of power station operation on the system of the Boston Elevated Railway Company it appears that the combined fuel and labor cost in the great Lincoln power station, fitted with mechanical stokers, is greater than in the Central power station, with its hand-fired boilers, and this in spite of the fact that the latter has much smaller generating sets and is the older station. With high-grade fuel, too, the care required in firing is decreased, so that it may well be doubted whether the favorable results shown in the English test could be repeated with first-class coal. One of these tests, by the way, shows an evaporation of 11.96 lbs. of water from and at 212 degs. per pound of coal, which is a high figure for any conditions, but this was under a water-tube boiler and with a fine grade of Welsh steam coal, the only case in which such fuel appeared. As this result has been equaled not infrequently by hand firing with similar fuel, one is only justified in drawing the conclusion, which one is inclined to dispute, that a first-class mechanical stoker is capable of doing work as good as the best.

We are very favorably disposed toward mechanical stoking. When properly conducted it gives very favorable and uniform results, and by its steadiness of fuel and air supply tends greatly to reduce smoke. In fact, we know of isolated plants that would certainly have been shut down long ago had they attempted to use their present soft coal with hand firing. It was a choice between mechanical firing and anthracite, with all the advantage on the side of the former. There are likely to be many more such cases, in which mechanical firing is imperative, even in plants of very moderate size. It is quite certain that stoking machinery has been greatly improved in the last few years, so that the questions of maintenance and depreciation are no longer what they were, and the care required to keep them in order has now been reduced to a very modest amount. It is a pity that more data on their performance with the best fuel are not attainable. It would be very interesting to see two batteries of boilers under test side by side using the same fuel, in one case delivered by a first-class modern stoker, and in the other by expert firemen, not for a few hours, but for a week, and then to compare the results. Some large electric plant considering the adoption of mechanical stokers could have the experiment tried to very great advantage. An allied question is the minimum size of plant in which it pays to use machine firing. Of course, when the employees are so few that they would be needed to look after the boilers and machinery generally, even if they gave over the coal shoveling to the machine, nothing is to be gained by the change unless the hand firing has been more than usually bad. One authority sets the critical capacity at 500 hp, another at as little as 300 hp. Evidently this depends again on the conditions of load and on the grade of fuel. It is difficult to show any gain up to the point at which a single fireman is unable to handle the necessary fuel comfortably. This would be at a point above 500 hp in the case of good fuel and boilers, and, in general, the more efficient the plant the bigger output one man can manage. With poor fuel and a rigidly enforced smoke ordinance, the machine would have the better of the argument, even at these small duties. But data on the continuous performance of mechanical stokers in plants of small and moderate size are badly needed. The question of their usefulness there is constantly being raised, and the most that can now be said is that they are advisable under especially favorable conditions.

POWER GENERATION AND DISTRIBUTION ON THE SYSTEM OF THE PUBLIC SERVICE CORPORATION OF NEW JERSEY—II

The electrical distribution problem confronting the Public Service Corporation of New Jersey after its acquisition in June, 1903, and subsequently, of what were fifty odd plants supplying electric light, power and railways, has been enormous. Twenty central stations and twenty-four sub-stations comprised the list of active plants, and some of these had previously replaced a multitude of others since the history of applied electricity began.



MAP OF NEW JERSEY, SHOWING TERRITORY COVERED BY THE PUBLIC SERVICE CORPORATION

The following article gives the capacity and equipment of the more important present active stations which are used in whole or in part for supplying the railway end: The newly completed plant of 13,000 kw capacity at Marion, N. J., with its provision for enlargement to 64,000 kw, which was described in the last issue of the Street Railway Journal, is an earnest of the units of high economy to be located at tidewater points. Thus the future will develop the further abandonment of the comparatively inefficient smaller stations and the increase of sub-stations for the supplying of electric light, power and railway energy.

An outline map of the State of New Jersey is given herewith, upon which the territory served by the electric lighting and power station is divided into three groups. For convenience these groups are designated Northern Jersey, Central Jersey and South Jersey. The locations of generating stations and sub-stations in the separate groups are indicated on the sectional maps herewith.

The stations are represented by solid circular spots and square spots, the sub-stations by hollow squares and by circles. The solid spots are stations in use now and which are to be retained. The solid squares represent abandoned stations or stations to be abandoned. The circles represent present sub-stations and the outline squares represent sub-stations abandoned or to be abandoned. The circles with a center line are sub-stations in course of erection. The letter *P* signifies power, *R* and *L* signify railway and light, respectively. Thus when *R* and *L* are indicated, the station or sub-station is for railway and light.

It will be noted from an inspection of these district maps that many generating stations are being replaced by sub-stations, and in some instances present sub-stations are being replaced by new sub-stations in better locations. This, of course, is to place them in the centers of distribution occasioned by the readjustment of load as planned by the engineers.

In the North Jersey group are comprised the new Marion station on the Hackensack River, between Jersey City and Newark; Coal Street and City Dock stations, on the Passaic River, in Newark; the Fourteenth Street station in Hoboken, on the Hudson River; the Secaucus station, near the Hackensack River; the Paterson station, on the Passaic River; the Elizabeth station, at Elizabeth, and two small independent stations at Morristown and Boonton. It will be noticed that all these stations except the two last and Hoboken are tied together by virtue of line connections each to the other, so that it would actually be possible to supply energy from Paterson to Elizabeth through the sub-station at Passaic, the Secaucus station, the Palisade Avenue sub-station in Jersey City, Marion station and the Newark stations at City Dock and Coal Street. This tying in of these stations has proved highly useful and guarantees practically continuous service by eliminating interferences in service from breakdowns in any of these stations.

In general the system of lighting circuits is 60-cycle alternating. The direct railway system is fed direct by 550 volts direct current with 13,200 volts, 25-cycle, alternating-current generators. This diversity of the generating supply was determined by the large investment in both classes of apparatus, about $2,000,000 having been invested in 25-cycle machines for railway distribution just prior to control of the various companies by the Public Service Corporation. Therefore, it was determined to carry in future plants and extensions both 60-cycle and 25-cycle apparatus. Thus in the new plant at Marion is 10,000-kw capacity of 25 cycles and 3000-kw capacity in 60 cycles, the former for railway and the latter for lighting and power work.

The Coal Street station at Newark contains the following generator and engine units:

Three 850-kw Westinghouse, 550-volt, direct-current generators, direct-connected to a Watts-Campbell cross-compound engine.

One 350-kw Westinghouse, 550-volt, direct-current generator, direct-connected to an Allis cross-compound engine.

Five 1800-kw General Electric, 13,200-volt, 25-cycle, three-phase generators, each direct-connected to vertical cross-compound Brown-Corliss engines.

One 3000-kw General Electric Curtis turbo-generator, 6600-volt, 60-cycle, three-phase.

There is one 1000-kw General Electric, 25-cycle rotary supplied by step-down transformers and providing 600 volts direct current.

All the engines are condensing. The boilers are Babcock & Wilcox, there being 15 of 250-hp and 12 of 500-hp each, run at 155-lb. pressure.

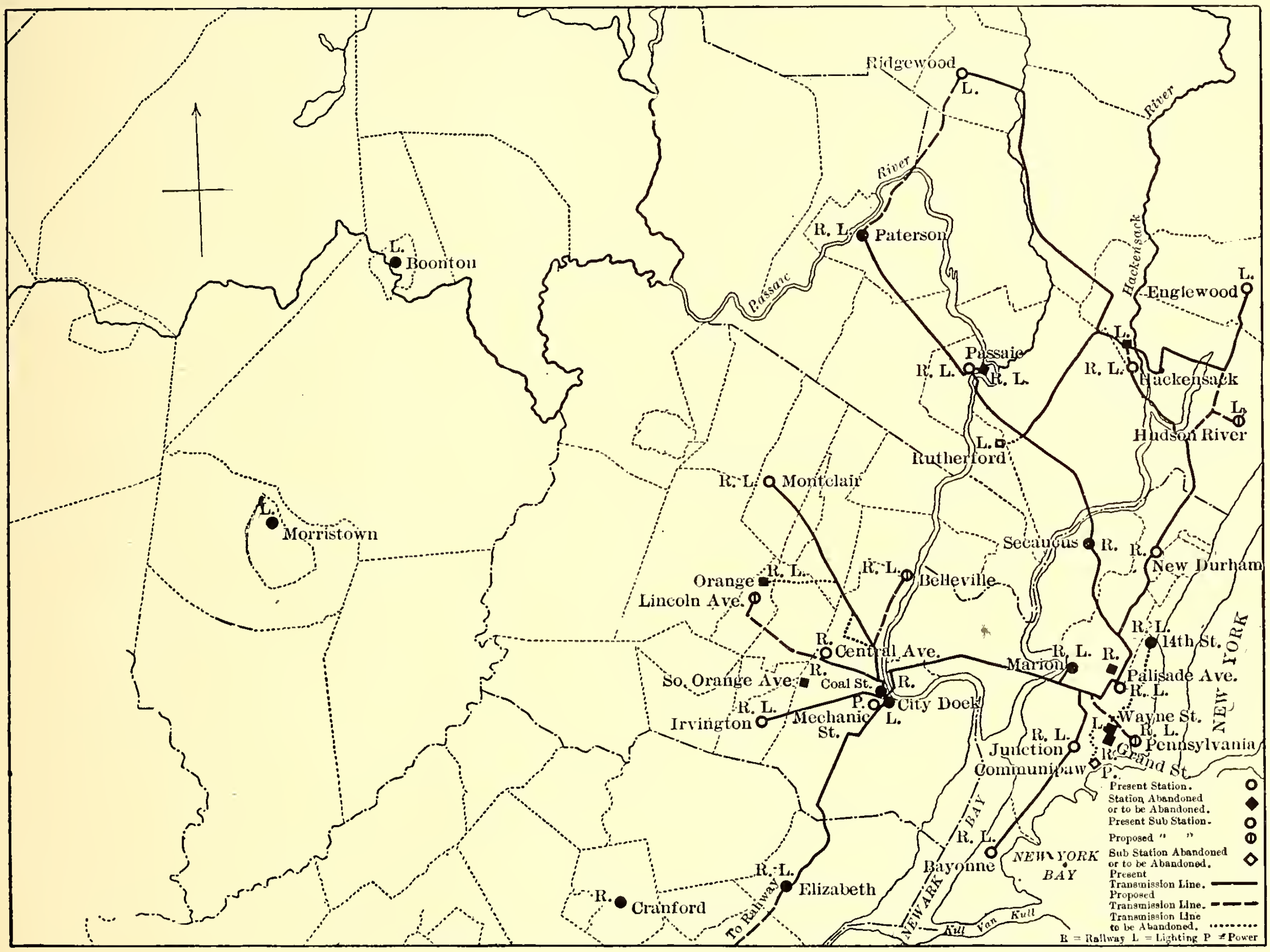
The turbine unit in this station is controlled in the adjacent City Dock station, the generator being classed as belonging to the City Dock station. Thus all units controlled at the Coal Street station are for the railway needs. The sub-stations are fed from this station by 13,200-volt, three-phase cables run in conduits. Central Avenue sub-station has two 1000-kw General Electric, 25-cycle, three-phase rotaries, 2½ miles away from Coal Street station, supplying 550 volts direct current.

Railway 550-volt current is supplied by the Coal Street station to the sub-stations at Irvington and Montclair, 4 miles and 7 miles away, respectively. Conduits in the streets of Newark carry 13,200-volt cables to the outlying district and thence the energy is taken overhead on 70-ft. poles.

The Irvington sub-station contains one General Electric, 1000-kw, three-phase, 25-cycle rotary and one 500-kw, General Electric, three-phase, 25-cycle rotary, both for railway 550-volt direct current. This sub-station contains five 17½-kw, constant-current transformers used for incandescent street lighting distribution, receiving its energy from the City Dock station at 2200 volts, 60 cycles.

The Montclair sub-station contains three 500-kw, General Electric, three-phase, 25-cycle rotaries, receiving their energy from Coal Street station at 13,200 volts alternating current and supplying 550 volts direct current for railway use. In this sub-station is also 2500 kw in General Electric, two-phase, 60-cycle, air-blast transformers, 13,200-6600; 2400 volts for lighting.

The City Dock station in Newark is a lighting and power station. The apparatus consists of seven Westinghouse 850-kw, 2300-volt, two-phase, 60-cycle generators, each direct-connected to a Pennsylvania Iron Works horizontal, cross-compound, condensing engine, and one Westinghouse 500-kw, 550-volt, direct-current generator, direct-connected to a Watts-Campbell horizontal cross-compound condensing engine. There are seven 500, two 600 and four 800-hp Climax boilers at 150-lbs. pressure. This station up to a year ago contained arc lighting machines that were thrown out by the present use of alternating-current arc lamps. The City Dock station, besides supplying the Irvington and the Montclair sub-stations in common with Coal Street, supplies Mechanic Street sub-station, which is solely used for power supply, and six street lighting transformer stations.



MAP OF NORTHERN NEW JERSEY SECTION SERVED BY PUBLIC SERVICE CORPORATION

An examination of the map of the district supplied by Coal Street and the City Dock stations with both light, power and railway service, reveals the fact of the present abandonment of the generating stations at Orange and South Orange, and the installation of two sub-stations; one at Lincoln Avenue, to take the Orange station load, and one at Belleville, to fill the increased requirements for railway and lighting in that section. The South Orange station's load is to be divided between the present two sub-stations at Central Avenue and at Irvington.

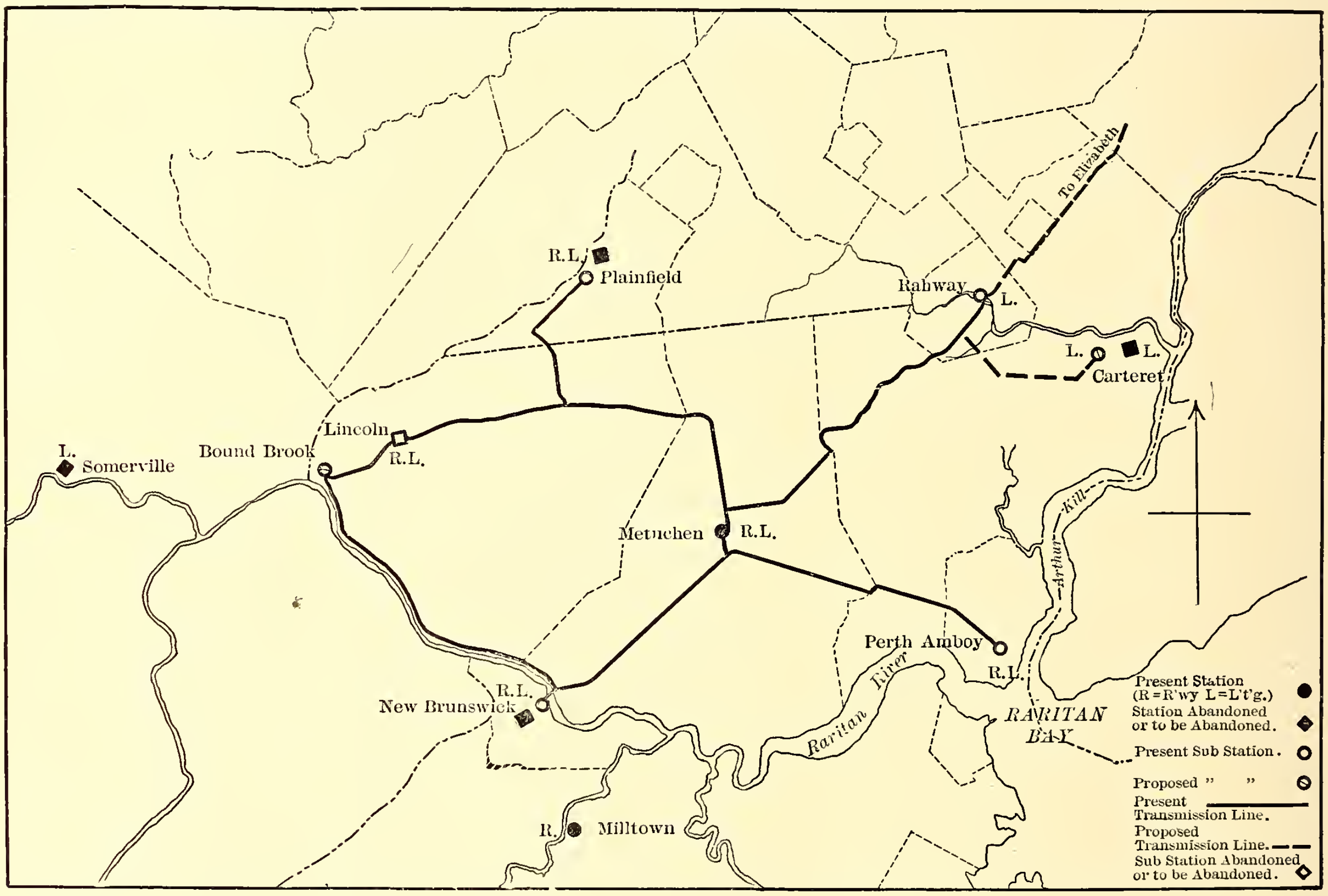
The new Marion station will play an important part in the more economical supply of light, power and railway energy in this section. Grand Street and Wayne Street stations, two old, small unit stations, and one sub-station (Communipaw), are to be replaced by the new sub-station (Pennsylvania) in this same district, and the present tie feeders connecting the three sets of apparatus with the Hoboken Fourteenth Street central plant, will be taken out.

The Grand Street station contains nine railway generators of 500 volts direct current. Wayne Street is also an old plant, consisting mainly of slow-speed engines belted to a jack shaft. It also contains one Westinghouse 300-kw, 6600-volt, 550-volt, 60-cycle rotary, used for power service and fed from the City Dock station at Newark through the feeder across the Hackensack Meadows, built over a year ago in anticipation of future use by the new Marion plant. This tie consists of three feeders, each of three No. 00 copper, stretched across the Hackensack marshes on two cross arms supported by two poles. Where the feeders run under the Passaic and the Hackensack Rivers three conductors, lead-covered, iron-armored and paper-insulated cables are used. There are cable and lighting arrester houses on both sides of the Hackensack River and on

60-cycle, 13,200-2600-volt, oil-cooled, Westinghouse transformers, fed from City Dock station, Newark.

The Secaucus plant is temporarily connected with four sub-stations—Palisade Avenue, New Durham, Hackensack and Passaic—with 13,200-volt, 25-cycle energy for railway distribution. The plant contains one three-phase, 25-cycle, 13,200-volt, General Electric, 1800-kw generator, direct-connected to an horizontal compound Brown-Corless condensing engine; two three-phase, 25-cycle, 13,200-volt, General Electric, 400-kw generators, each direct-connected to an horizontal compound condensing Watts-Campbell engine; three direct-current, 550-volt, Westinghouse, 350-kw generators, each directly connected to a Bass horizontal, cross-compound condensing engine. The boilers are two 500-hp and four 250-hp Babcock & Wilcox, at 200-lb. pressure, and four 320-hp Climax at 200-lb. pressure, run at 125 lbs.

The New Durham sub-station contains two General Electric,



MAP OF CENTRAL NEW JERSEY SECTION SERVED BY PUBLIC SERVICE CORPORATION

the east side of the Passaic. Three conductors, No. 00, lead-covered, paper-insulated cables are run underground from the east cable house to the Marion power house. There are also in Wayne Street eight 100-kw Wagner, oil-cooled, 6600-2400-volt transformers, used for commercial incandescent lighting as step-down transformers from the Newark station. The concentration of service supply for railway and lighting to the Pennsylvania sub-station and the abandonment of the comparatively uneconomical plants of Wayne Street and Grand Street will make for economy in copper and in kw-hour cost.

The Palisade Avenue plant has been shut down since last spring. It consisted of small generators belted to jack shaft and slow-speed engines. The Palisade sub-station, temporarily fed from Coal Street and Secaucus, will be fed entirely by the Marion plant and consists of three 1000-kw, three-phase, 25-cycle, General Electric, 13,200-550-volt, direct-current rotaries for railway and two 500-kw, three and two-phase,

1000-kw, 13,200-volt, 25-cycle rotaries giving 550 volts direct current. The Hackensack sub-station contains two 300-kw, General Electric, 13,200-volt, 25-cycle rotaries feeding 550 volts direct current. This sub-station can also be fed from the Marion and the Coal Street plants by way of Secaucus station and Palisade Avenue sub-station, as the Secaucus bus can be tied in to the Coal Street plant. The Passaic sub-station contains one 1000-kw and one 300-kw, General Electric, 13,200, 25-cycle rotary, giving 550 volts direct current for railway service. The Passaic sub-station, feeding from Secaucus, can also be fed from the Marion and Coal Street plants. The capacity in 13,200-volt, 25-cycle generating apparatus given by the Marion station permits the shutting down of the Passaic generating plant, as the Passaic sub-station contains also step-down lighting equipment supplied from the Paterson plant as follows: Two Wagner 100-kw, 6600-2600-volt, two-phase, 60-cycle, oil-cooled transformers; two General Electric transformers of like capacity and style, and one Stanley 2000-1000, 60-kw, single-phase, 133-cycle transformer used for incandescent street lighting.

The Paterson plant, as soon as changes can be made, will naturally go the way of the small unit plants, but cannot be spared for some time to come. It contains a number of small units for railway and incandescent lighting.

The Hackensack plant has lighting apparatus only and will be shut down.

The Ridgewood, Rutherford and Englewood sub-stations contain lighting apparatus only. These three sub-stations will be fed from the Marion plant and a new sub-station, called the Hudson River, is to be erected part way between Englewood and New Durham.

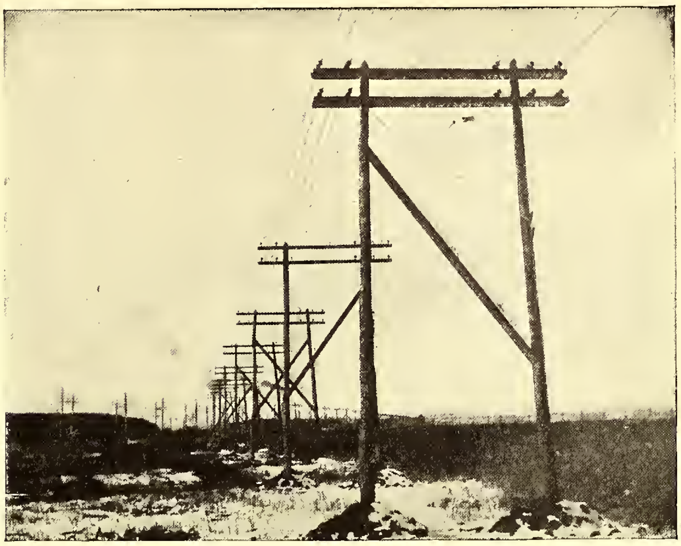
The Hoboken plant at Fourteenth Street and the Hudson River will be retained, as all its capacity is required in the immediate vicinity. The district is rich in possibilities for power distribution. The present tie line with Jersey City at the Wayne Street station is to be dispensed with and the Hoboken plant relieved of this portion of its load, will permit the plant to better care for its own requirements for several years to come. In addition to lighting apparatus, this plant contains three 850-kw, direct-current, General Electric, 550-volt generators, each direct-connected to a Pennsylvania Iron Works cross-compound condensing engine.

The other stations in this section contain a miscellaneous assortment of generating apparatus for railway and lighting, some of it modern and some more or less antiquated.

CENTRAL JERSEY SYSTEM

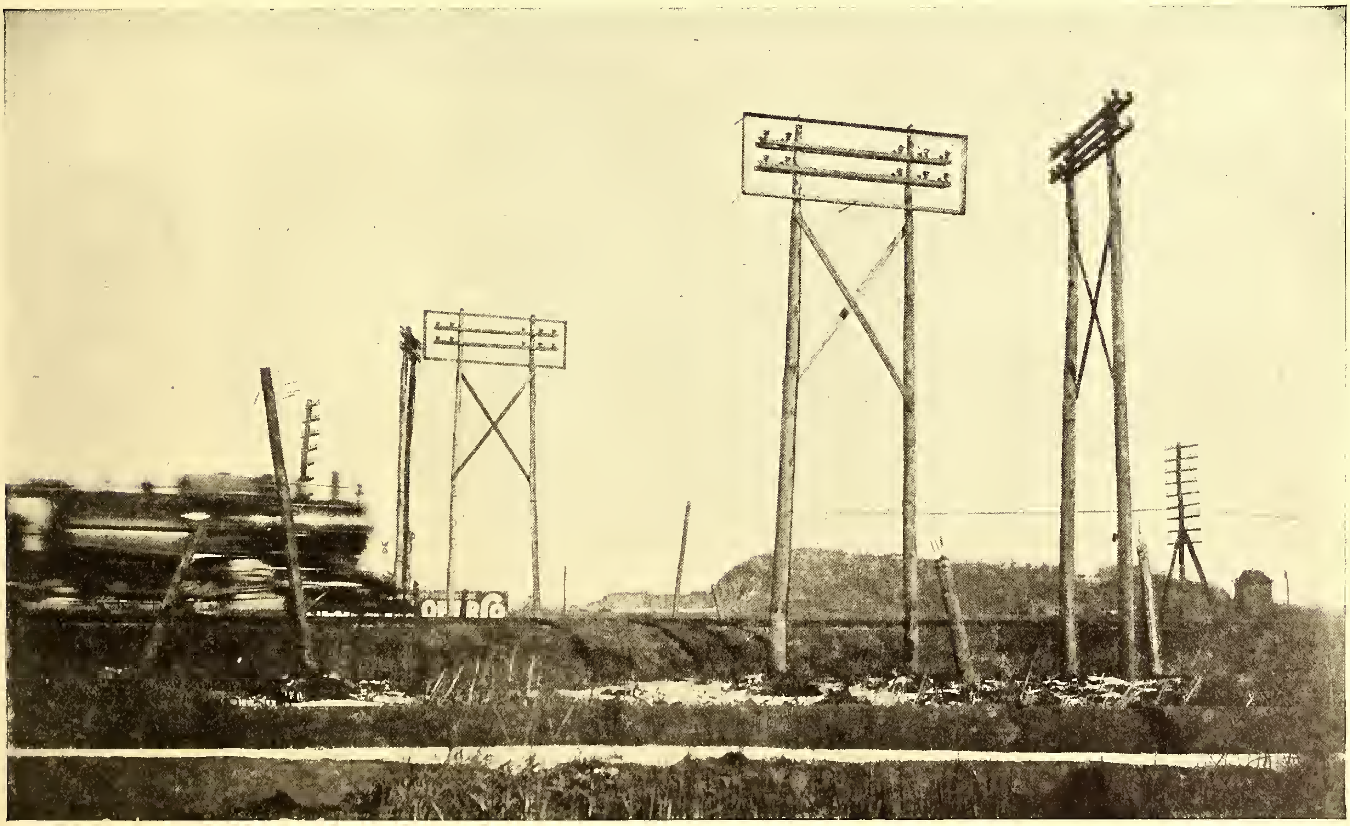
The Central Jersey system, which at present consists of five central plants and three sub-stations, will shortly be supplied from two plants and seven sub-stations, and the light and railway plant at Metuchen will be connected with the plants of the Northern New Jersey system by means of the tie feeders from the sub-station at Rahway to be run to Elizabeth, the latter already being connected with Newark.

The important plant in this section is at Metuchen, supplying sub-stations in Rahway, Carteret, Perth Amboy, New Brunswick, Bound Brook and Plainfield. Each of these sub-stations replaced generating plants, which in general consisted of countershafting and old type generators with slow-speed simple engines, or small units driven from simple high-speed non-condensing engines. The locations of all these plants made it necessary to cart all coal used at a cost of from 28 to 40 cents per ton, and every one except Bound Brook was obliged to purchase water for boiler supply.



TYPICAL TRANSMISSION LINE, PUBLIC SERVICE CORPORATION

The Metuchen station consists of two 1000-kw Curtis-General Electric turbo-generators, 13,200-volt, three-phase, 60-cycle; two S. K. C. 500-kw, 6600-volt, three-phase, 60-cycle generators, direct-connected each to a Pennsylvania cross-compound condensing Corliss engine; three Stanley 50-kw, 6600-2300 volts, three two-phase, 60-cycle, oil-cooled trans-



VIEW SHOWING IRON WIRE CAGE AROUND HIGH-TENSION LINES OVER STEAM RAILROAD CROSSING, PUBLIC SERVICE CORPORATION formers; two three-phase, 500-kw, 60-cycle transformers for stepping-up the Stanley generators to the bus-bar 13,200 voltage, and one 300-kw, three-phase, 60-cycle rotary, transforming to 600 volts direct current. There are two 600, one 700, and two 800-hp Climax boilers at 150-lb. pressure.

SOUTH JERSEY SYSTEM

The present South Jersey system consists of the lighting stations at Trenton, at Bristol and at Mount Holly, together with the light and railway plant at Camden and the sub-stations supplied by the Camden plant at Moorestown, Merchantville, Haddonfield, Gloucester and Woodbury. The Gloucester substation is now replacing the old plant at that point.

At Camden the railway end is supplied by one General Electric, 200-kw and one Westinghouse, 225-kw, 550-volt, direct-current generator, each belted to one of two vertical cross-compound condensing Ball engines; two Westinghouse, 800-kw, 550-volt generators, each direct-connected to a Pennsylvania Iron Works horizontal cross-compound condensing engine, and one General Electric, 600-amp., 100-volt booster, driven by a direct-current, 500-volt motor on the same shaft. As the South Jersey distribution system is used largely for electric lighting, an enlarged map diagram of it is not reproduced.

THE EFFECT OF CONSOLIDATION OF PUBLIC SERVICE INTERESTS ON THE LOCAL REPRESENTATIVE

BY WILLIAM PESTELL

The striking modern tendency of electric railway and lighting companies has been toward consolidation of the controlling interests. In these days, when every industry, from the growing of lobsters to the manufacture of steel, is being or has been "organized," it is not surprising to see the same trend in the fields of electrical and mechanical engineering, nor is the intention behind the great movement hard to find. From the smallest local industry to the great aggregations of capital controlling public service corporations, success depends upon "organization." Its aim, in short, is this: To secure economy and a larger field of operation by, first, a centralization of executive power which assures a consistent and recognized general policy, the highest efficiency of superintendence, a minimum of waste of both energy and material by preventing duplication of effort, and by intelligent buying in large quantities. The second object sought is to secure efficiency of operation by the most minute specialization, by which is meant that the man is perfectly adjusted by former training and experience to his work, rather than that the work is adjusted to suit the abilities of the man. By this method, each man knows the exact limitations of his field of work, and his duty is to cover this field thoroughly, quickly and for the highest interest of his employer. He is a cog in a perfectly regulated machine.

The utility of centralization and specialization is unquestioned in commercial life of to-day. Its present application to public service corporations, however, is unsatisfactory in some details of practical operation. I do not in the least underestimate the immense advantages it has bestowed, but I believe it is time to call attention to one salient point where friction exists in the machine. I have mentioned the advantages of consolidation—which connotes centralization and specialization—and they are many. In the first place it has gathered into compact groups the highest engineering and executive talent of the country. It has enabled the small properties to employ this talent in supervision of improvement; expense alone, apart from other obstacles, would render this impossible but for perfect organization. Moreover, by a magnificent system of reports, it makes possible a comparison of the operation of various properties, which, in the case of properties on a poorly-paying basis, is of inestimable benefit.

In the face of such advantages conferred, it is perhaps excusable if any accompanying detriment has been overlooked. Nevertheless it exists. It exists in the local representative and in his relation to the central organization. Public opinion of a company, an unassailable asset when once established, is, in a public service company, largely based on two things—services rendered and local administration. The average commuter knows little and imagines less of the perfected systems developed to facilitate his transportation. They mean nothing to him. But if his car is 10 minutes late on a stormy morning, or if he is unable to get a prompt decision on an apparently trivial matter, he is loud in his denunciations. Public opinion of a company depends no less surely, but in a less degree, upon the employee's opinion, which is based upon the treatment he receives and upon the apparent authority of his local superior. If, in the development of its central organization, the company has dwarfed or belittled the local organization by presuming to dictate a hard and fast policy, regardless of local conditions or opinions, as reflected by its representative on the ground, the company is bound to suffer. If the company has curtailed too greatly the authority vested in either its local manager, superintendent or engineer, it has lost sight of that important factor, the personal element, so necessary in the handling of men, be it its employees or the public. Since the company's reputation depends so greatly upon its local representative, he should be a man carefully selected and should be given authority in accordance with his responsibility. He should be vested with authority to settle on the spot all matters not affecting the general policy, and therefore he should be so thoroughly informed in regard to the general policy as to be able, before rendering a decision, to use judgment in determining the necessity of consulting higher authority.

It may be said that it is impossible to get suitable men for the large number of positions now open. This appears true, as is evidenced by the comparatively large salaries paid to responsible men for the management of properties at great distances from the central organization. But it is a fact that the present practice of seriously limiting the authority of local representatives is not only spoiling men now in such positions, but is slowly and surely obliterating all possibilities for development of good material. The first requisite of a successful public service corporation manager is a thorough understanding of human nature, and no man can acquire this thorough understanding who is not allowed to think and act for himself in his dealings with other men. And this the "average" local representative is not privileged to do under the present system.

Anyone who has served a modern consolidated company as local representative will fully appreciate the truth and validity of this assertion. Managers and officials of large companies, who have seen scores of apparently able men, the graduates of our colleges and technical schools, make dismal failures when put into responsible local positions, would do well to ascertain whether this relation of utter dependence of the local representative upon the central organization is not the cause of these apparent failures.

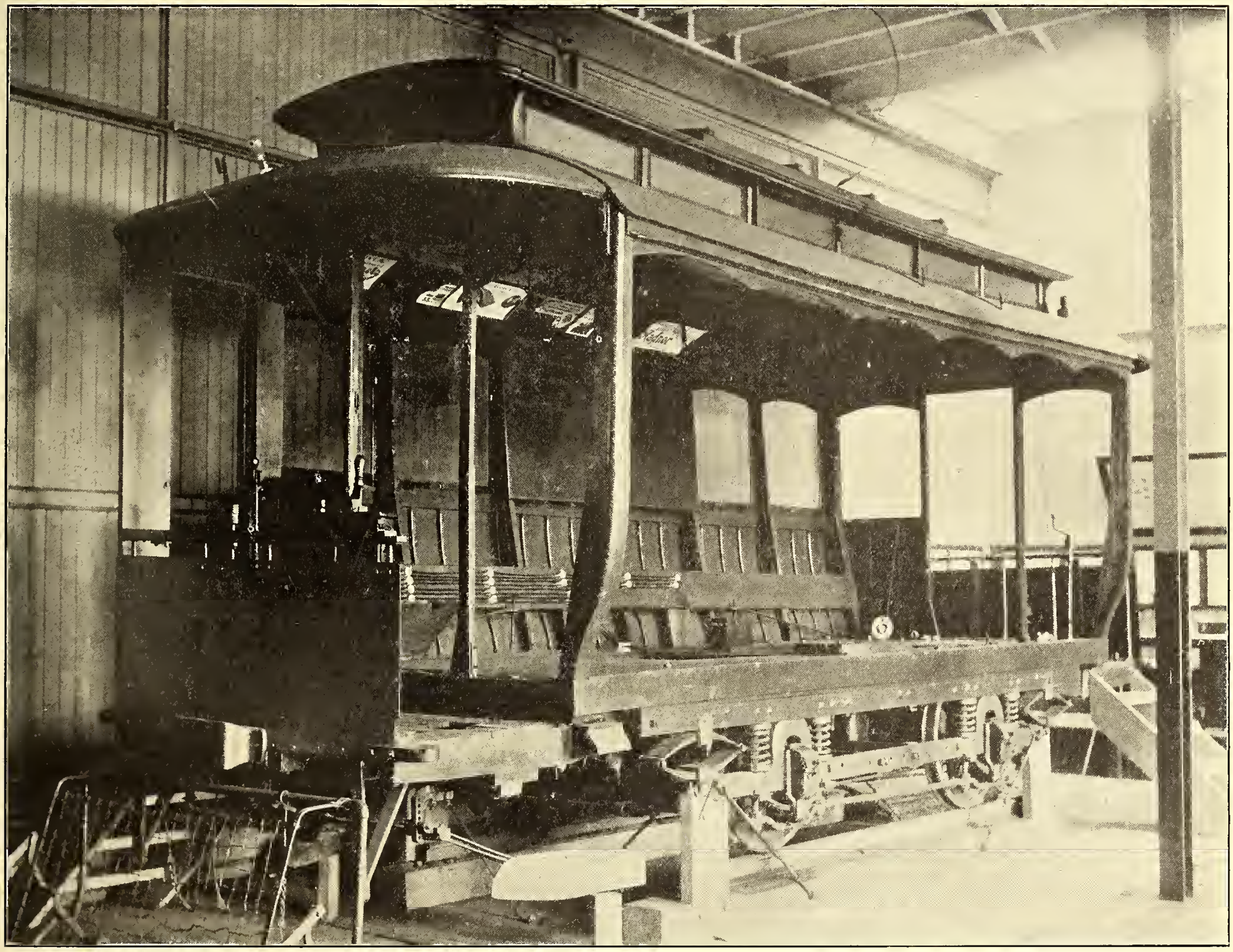
If it be urged that many such graduates are placed in responsible positions before they have acquired sufficient experience in the handling of men, whether employees or the public, I repeat that the present system is absolutely inadequate, in that it affords such men no opportunity to develop the requisites for successful management, but rather places them in a position of dependence, which ultimately destroys initiative power and firmly shackles the most potent individuality.

F. H. Thomas, passenger and excursion agent of the East St. Louis & Suburban Railway Company, has adopted a novel method of advertising the excursion business of that railway by issuing a keyring tag which bears a view of one of the cars of the company, a short advertisement and a space for the name of the owner.

EMPLOYEES TRAINING SCHOOL AT MONTREAL

In order to assist in the training and the educating of its men, the Montreal Street Railway has a training school in which ambitious recruits are systematically taught how to become not only acceptable motormen, but fairly good electricians, thoroughly familiar with the mechanical and electrical equipment of a car and the proper manipulating of the apparatus. The men employed by the company are required to present a neat and tidy appearance, and before they are admitted to the training school they are examined by the company's doctor. Applicants who have successfully passed the physical examination are allowed to fill out an application blank and are admitted to the school. Each recruit is assigned to one of the dummy car platforms in the school room, which are fitted with controller, brake, gong and sand lever. During the few days passed on the dummy platform the prospective motorman is taught how to start his imaginary car without hurling the passengers from their seats, and how to stop gradually under ordinary circumstances, and quickly in case of emergency. The advisability of turning the controller handle on one point at a time, also the limit of time on each point, is forcibly impressed on the students. In order that the men may become familiar with the conductors' signals, the chief instructor conveys his orders by means of an ordinary car bell. When they have become familiar with the working of the controller and brake, they are then taught something about the mysteries of electricity. The casing of a controller is opened so they may see how it is constructed, and the meaning of each point is explained. The men are also taught how to cut out a disabled motor and how to manipulate the reverse. The school is equipped with an operative skeleton car jacked up from the track so that the wheels may spin even more freely than they would on the road.

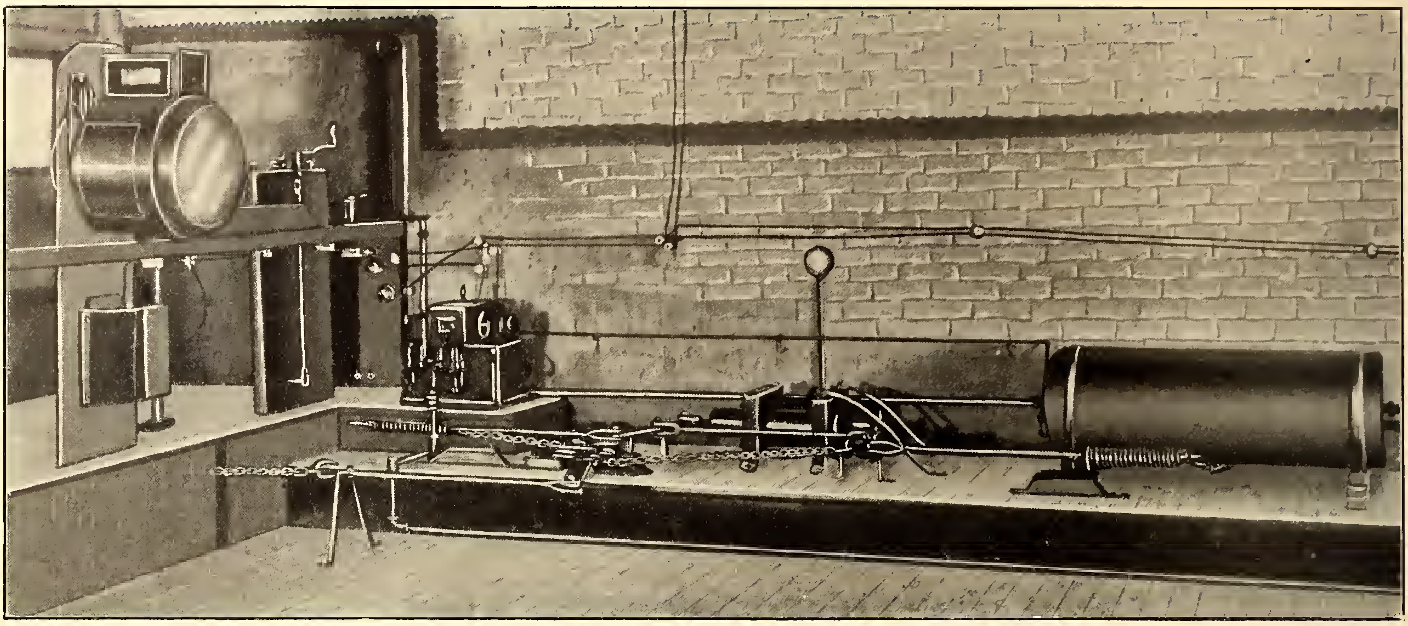
At this period the men enter upon the most difficult part of their education. On the road they must be able not only to run their cars in a manner which would be a credit to them, but they must also be able to do slight repairing whenever occasion may require. Accidents of all kinds may happen and they must be able to cope with them. Before they graduate they are placed on the skeleton car and instructed how to operate the apparatus of which they are in charge and how to locate open circuits. When the applicant has learned in the school all that he need know, he must pass through a post graduate course on the road under the guidance of an expert motorman, and is required to stay on the first line seven days. After he has trained over all the various lines, the new man then goes to the repair shops for a period of five days, where he must learn how to do slight repairing on the road.



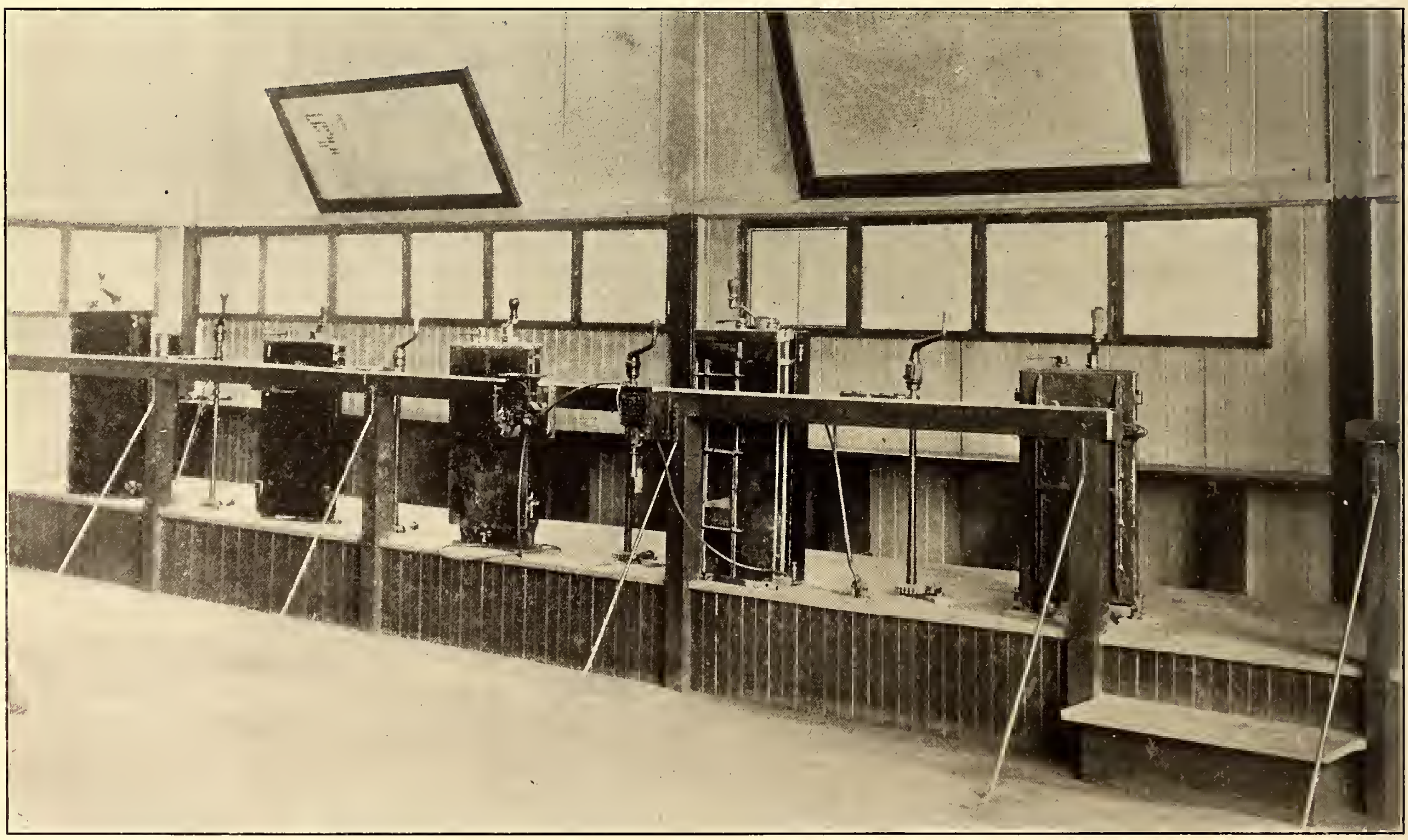
SKELETON CAR—MONTREAL SCHOOL FOR EMPLOYEES

After he has concluded his course in the shop the student then comes back to the chief instructor, who in turn takes him over some of the various lines in order to determine his capabilities of operating a car on the road. If he should not prove competent he is sent back for a more thorough training, providing there is still hope of his becoming a motorman, but if in the event the chief instructor sees that his incompetency is due to carelessness and neglect other than lack of training or nervousness, he is summarily dismissed. All men who prove to be competent are taken back to the training school for their final examination, where they are required to answer in a satisfactory manner all questions put to them by the chief instructor.

After the new men have been in the company's service for about a month and have proven to be good, careful motormen they are allowed to train on the air-brake cars, which up to that time they are not allowed to run. The training school is equipped with air brake apparatus which consists of exactly the same parts as are mounted underneath the car, with the air brake and the hand brake connected up in the same manner as in actual operation. The men are taught how to apply the air so that their cars may stop gradually without jerking. The importance of releasing the brake before the car comes to a stop is also explained. They are warned that on a slippery rail they must apply the air very gradually in order to avoid skidding the wheels, and are told that, as a matter of fact, even should the rail be in perfect condition, if the air brake is applied too suddenly the wheels are likely to skid and flat wheels will be the result. By having the air brake equipment in the training school, it is found possible to give each motorman a thorough understanding of the operation of the brake. The school and work of training employees are in charge of J. Callaghan, inspector and chief instructor.



AIR-BRAKE APPARATUS, CONTROLLER AND HEADLIGHT—MONTREAL SCHOOL

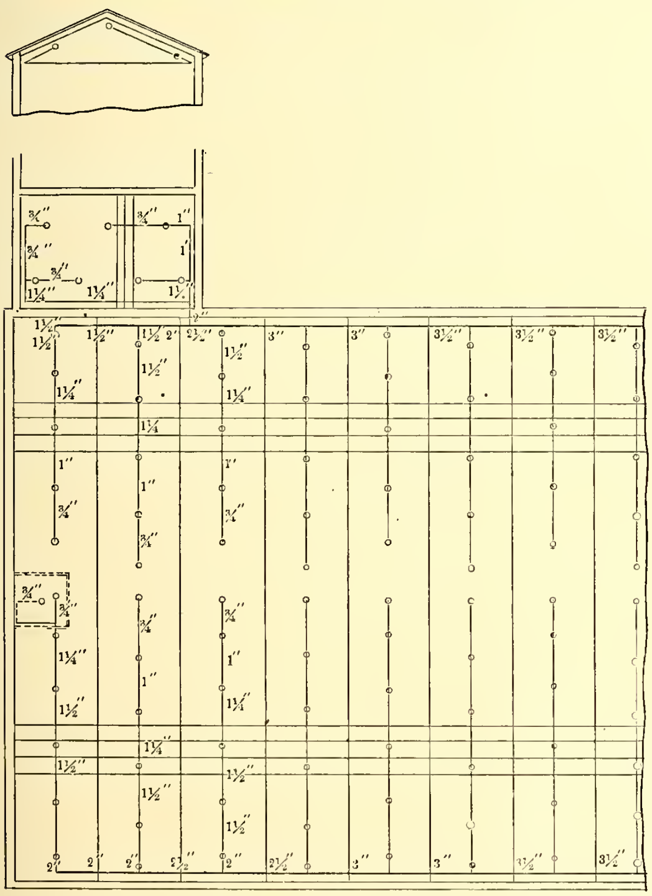


CONTROLLER PLATFORM, SHOWING CONTROLLERS, CIRCUIT BREAKERS, FUSE BOXES, MAPS AND DIAGRAMS USED IN MONTREAL SCHOOL FOR INSTRUCTING CONDUCTORS AND MOTORMEN

CAR HOUSE SPRINKLERS AT ALBANY

The United Traction Company, of Albany, N. Y., is equipping all of its car houses, shops, stables and emergency stations with automatic sprinkler systems, including side line, or aisle sprinklers, for extinguishing fires in cars. These buildings are grouped in four plants, located respectively at North Albany; Quail Street, Albany; Albia and Lansingburg.

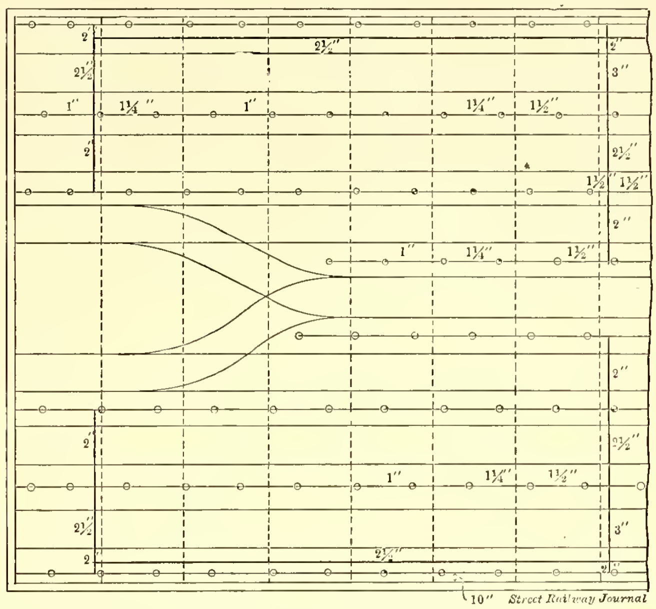
The North Albany car house includes two main operating and storage buildings, separated by a narrow alleyway, and also a repair shop, emergency station, stables, storage house and substation. The capacity of the plant is seventy cars. The buildings are brick throughout, with concrete pits and floors, and plank roof supported on light steel girders, with a covering of five-ply slag roofing on top of the plank roofing. The Quail Street plant, which has capacity for about 100 cars, is built with brick walls and reinforced concrete roof. The Lansingburg plant, which has storage capacity for about 200 cars, comprises a brick building with plank roof supported on steel trusses and covered with five-ply slag roofing. Adjoining this building there is a small heating plant and a small reserve power station, and these buildings are also included in the general protection scheme. The Albia plant, which is practically a duplicate of the Lansingburg house on a smaller scale, has a capacity of fifty cars.



PLAN SHOWING ARRANGEMENT OF CEILING SPRINKLERS, NORTH ALBANY CAR HOUSE, UNITED TRACTION COMPANY

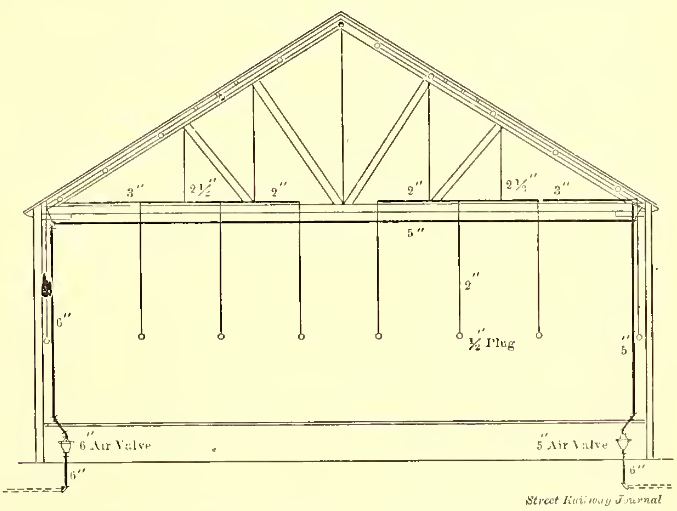
These plants include all of the buildings owned by the United Traction Company, with the exception of the main office building, which is a fireproof brick and steel structure; the steam power plants of the system and two buildings used for freight and express. The reason for not installing sprinklers in the steam plants is found in the fact that the United Traction system is now operated entirely by power purchased from a water-power company, and the steam stations are merely held in reserve for emergencies, and as no occasion has arisen for their use in the past two years, they will doubtless be dismantled some time in the future. The express buildings were not included in the scheme inasmuch as the express business is still in a transitory state and the plans for permanent buildings are not fully perfected.

After consultation with the Board of Fire Underwriters of the State of New York, an agreement was finally reached between the underwriters and the traction company whereby the insurance rate would be materially reduced providing the traction company would do the following things:



PLAN SHOWING ARRANGEMENT OF SIDE-LINE SPRINKLERS, NORTH ALBANY CAR HOUSE, UNITED TRACTION COMPANY

Put in ceiling sprinklers and side line or aisle sprinklers between tracks at the car house in Albia, Lansingburg and North Albany, and side line or aisle sprinklers only in the car house at Quail Street. As the Quail Street building has a concrete roof it was not deemed necessary to install ceiling sprinklers in this plant. The traction company also agreed to install at each plant, as auxiliary to the city water supply, a 25,000-gal. tank supported on a 75-ft. structure. The sprinklers are to be on the dry-pipe system in all car house and other buildings where there is possibility of freezing. The company also agreed to put in automatic air compressors at each of the four plants to maintain suitable air pressure for the dry-pipe system. These compressors will consist of a Christensen motor-driven air-brake



SECTION THROUGH NORTH ALBANY CAR HOUSE, SHOWING COMBINATION OF CEILING AND SIDE-LINE SPRINKLERS compressor, of the type ordinarily installed on cars for air-brake operation. All of this work is to be done under the direction and supervision of the Board of Fire Underwriters of the State of New York.

It may be stated that in consideration of the installation of fire extinguishing apparatus as outlined, the underwriters have guaranteed a reduction in fire insurance rates which, at the cost of installing the entire apparatus, will pay for the sprinklers, compressors and tanks at all the plants in approximately five years, neglecting the single item of maintenance. The United Traction Company has contracted with the General Fire Extinguisher Company, of Providence, R. I., to install the complete systems, including, in addition to the Grinnell automatic sprinklers, the tanks, hydrants, underground piping and post-indicator valves controlling each branch into the buildings.

The installation in the Lansingburg buildings includes a wet and dry-pipe system of 2674 Grinnell automatic sprinklers, and fire extinguishing apparatus distributed on the ceiling of the car house proper, on the ceiling of the loft and between the tracks on side line piping placed about 8 ft. above the car house floor. Grinnell sprinkler heads will also be placed in the engine room and boiler room at this plant.

The North Albany plant includes 1920 sprinkler heads, and the Albia plant 661 heads, properly distributed in the ceiling and on the side lines between the tracks. The Quail Street plant will have 725 heads, placed for the most part on side lines, as this building has a concrete roof, and the ceiling sprinklers have been omitted. In all cases the side lines will be placed about 8 ft. above the car house floor, in line with the top of side windows of the cars.

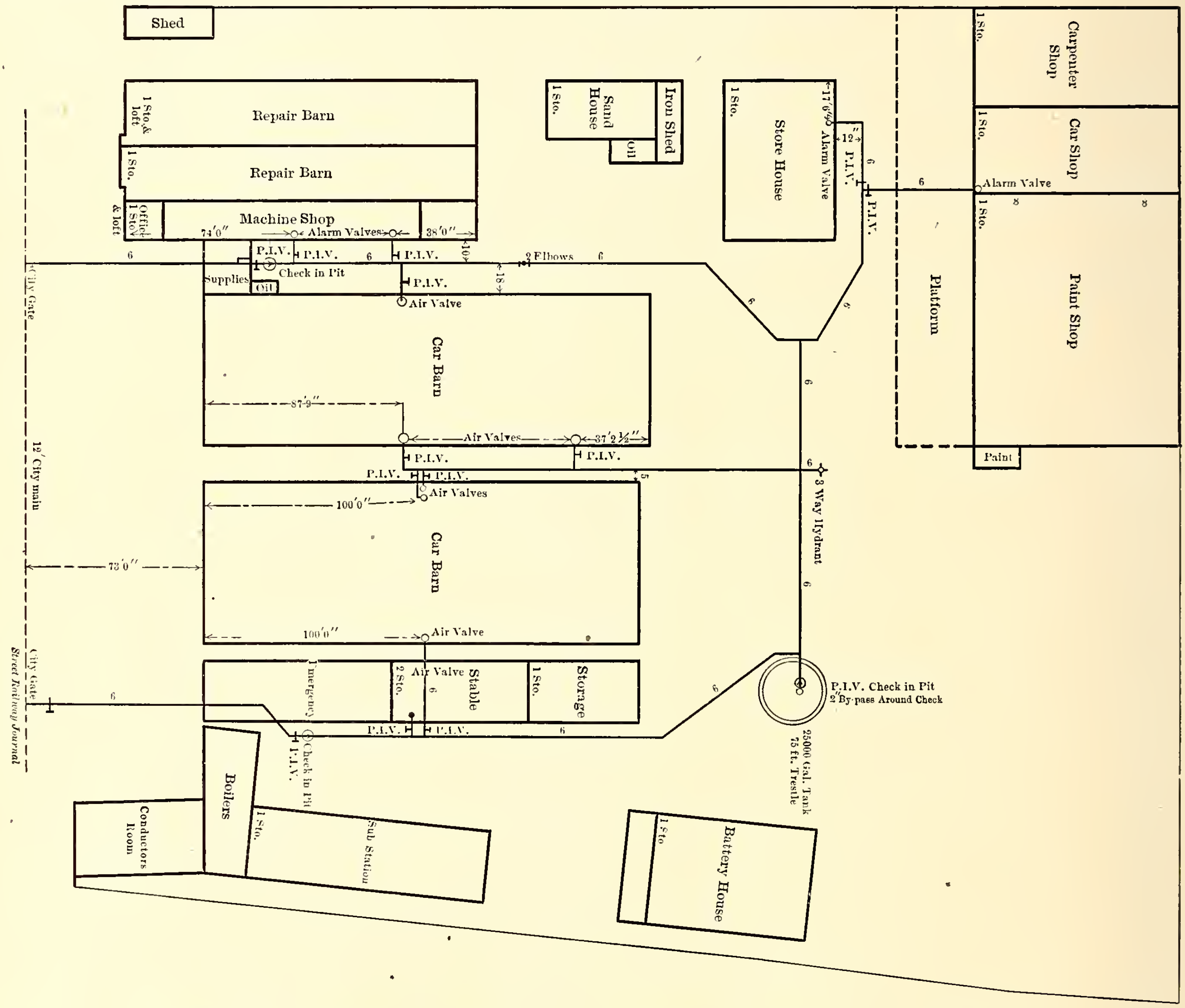
Owing to the general construction of the buildings, the ceiling sprinkler heads have been spaced so that each one covers approximately 70 sq. ft.

The aisle sprinklers are placed not over 7 ft. apart midway between cars, and where cars are over 4 ft. apart two lines have been put in.

At each of the four plants the 25,000-gal. tank will be placed outside of the building on a steel tower 75 ft. high. From the tank in each case a 6-in. pipe connection runs to the system of underground piping constituting the supply main for the sprinkler pipes in each building. At all the plants the sprinkler main is also connected with the city water supply, and the tank serves as an auxiliary reserve to fill the sprinkler system in case the pressure in the city mains drops below 60 lbs.

To prevent water in tanks from freezing, a coil supplied with live steam is placed in each tank. The 6-in. connection supplying sprinkler systems and steam supply and return for coils are all boxed in with frost-proof covering.

In each case the installation includes Grinnell dry-pipe valves, variable-pressure alarm valves and necessary gages, electric circuit closers, drop annunciators and water-motor alarms with gongs located at convenient points in the plant.



MAINS FOR SPRINKLER LAYOUT, NORTH ALBANY PLANT, UNITED TRACTION COMPANY

NEW ENGLAND STREET RAILWAY CLUB

The December meeting of the New England Street Railway Club was held in Boston at the American House on the evening of Dec. 28. The topic under consideration was a paper on "Lightning Protection," by H. W. Young, of the Boston office of the Westinghouse Electric & Manufacturing Company.

In beginning his paper, Mr. Young pointed out the necessity of appreciating the fundamentals of lightning protection for both the high and low-tension ends of electric railway work if a maximum degree of protection is to be obtained with a minimum expenditure for original outlay and upkeep. In planning a new station, space should always be allowed for the protective apparatus, in order that it may have proper insulation, ventilation and accessibility. Each separate line leaving the building should be provided with one arrester having a voltage rating somewhat exceeding the voltage existing between line and ground when one of the wires of the system is grounded. If the local conditions in the way of thunder storms and winds are severe, specially heavy insulation is needed. When transformers are placed between the generators and the line, the requirements are simpler. The value of protection is directly proportional to the difference in resistance to static discharges offered by the protective device and the apparatus shielded. Preference should naturally be given to devices having the lowest equivalent spark gaps—by which is meant that length of gap which, when placed in parallel with the apparatus, will just fail to take the discharge.

The most modern apparatus for testing arresters is that designed by P. H. Thomas. A high-voltage transformer connected to the supply circuit through an impedance coil, charges a condenser capable of being intermittently discharged by means of a swing switch. The resulting current is purely electrostatic, owing to the fact that the flow of transformer short-circuit current at the interval of closing is so limited by the impedance that it becomes negligible. The condenser discharge breaks down the series gap, and the charge is thrown upon the arrester or other object under test. A measuring or equivalent spark gap is placed in multiple with the arrester, and the opposite side of the circuit is grounded. Tests requiring considerable power can readily be made with this equipment.

The equivalent spark gap of an arrester should be of considerably lower value than that of the apparatus to be protected. With new equipment, the relative strengths can easily be determined, but after apparatus has been in service, and especially if it has been overheated or otherwise abused, the relative protection offered by such a device becomes lower and lower. Finally a point might be reached where the insulation would be so poor that it would afford a far freer discharge path than the protective devices themselves. In a new plant these considerations need not be specially borne in mind.

Mr. Young's paper was illustrated by lantern slides, and a large variety of apparatus was shown, together with experiments in high potentials, the latter being clearly photographed. The speaker described the various types of arrester which have given the best results in practice, notably the multigap arrester with resistance pencils in series, the multigap with non-arcing metal cylinders, and the horn type. He stated that the arrester with non-arcing cylinders has the lowest equivalent spark gap of any arrester for the service for which it is designed. It has an instantaneous current carrying capacity, which aids in clearing the line of surges, and operates with such freedom of discharge that it does not open the circuit breakers on systems where they are particularly lightly set. The degree of protection with this type of arrester depends upon the number of series gaps, the shunted gaps being so proportioned that they will break down when subjected to the potential which results from the discharge of the series gaps. The number of series gaps is just enough to withstand normal voltage and allow a proper margin of safety for the severest condition, which is one line grounded. Arresters for potentials exceeding 18,000 volts are adjustable to meet local conditions. In the event of a hold-over with this type of arrester—called the "low-equivalent" type, frequently—the only failure of the arrester would be in the fusing of its resistance, which would immediately open the circuit. This fusing action, however, is a remote one, and in consequence of the great life of the arrester, is relatively unimportant.

The horn type of arrester requires the addition of a resistance to cut down the flow of current on short-circuits, if its life is not to be seriously impaired. Even then the time element in extinguishment, common to all forms which have proven to work, is several seconds in duration, which would doubtless impair the usefulness of this type for railway work. It is an undesirable type for indoor service, and thus far the resistance used has proven extremely fallible.

Choke coil protection in the form of a simple choke coil or a static interrupter is desirable in all high-potential installations. The choke coil may be placed directly in the line leads or in the terminal leads of the apparatus; the static interrupter is applicable only on the terminals of apparatus between the switches and the equipment protected. The placing of coils in the line leads is not in general considered as satisfactory as placing them in the leads of apparatus. For, in the latter case, they allow of the most economical expansion of the station and give a desirable protection against the strains arising from switching. The static interrupter differs from the choke coil in the addition of a condenser between the coil and the apparatus protected. The condenser has the effect of increasing the effective impedance of the coil to high frequency discharges, although the insulation must be designed to protect the coil from side flashes.

Mr. Young then discussed the protection of low-potential circuits of 600 volts or less, stating that while the feeders require little protection, the arresters should be spaced so as to drain the trolley of as much of the disturbance as possible before it reaches the cars. Five or six arresters per mile is the proper number, determined by tests. The speaker stated that he was not aware that this installation of five or six arresters per mile had ever been consistently carried out, which perhaps accounts for the lack of complete success so far reported in this phase of the service.

Every car should have a lightning arrester, for the relative freedom of discharge of arresters and apparatus is no more important than at this part of the equipment. The speaker described several different types of arresters, laying special emphasis upon the "fixed coherer" type, or "multipath" arrester of the Westinghouse Company. This arrester resembled in action the coherer used in wireless telegraphy, and it is essentially a small number of air gaps in series with a so-called discharge block which may be conceived of as possessing a large number of conducting particles suspended and separated by an ordinarily non-conducting medium. On either side of the discharge block are fastened brass plates, connected respectively to the ground wire and line. As the static discharge comes in it jumps the primary gap, and, meeting slight opposition in the coherer element, or discharge block, passes freely to earth. The line current cannot follow, for the conducting particles do not cohere, as in wireless telegraphy. The discharge block is so proportioned that the length of discharge path is short as compared with the surface presented for discharge; therefore the static charge spreads out over numerous paths.

Mr. Young then referred to the records obtained from operating companies during the past year and a half under actual service conditions, discussing the special paper records taken from arrester discharge gaps, and illustrating his remarks by actual test sheets. The method and results were described by N. J. Neall in a paper read Oct. 27, 1905, at the 200th meeting of the American Institute of Electrical Engineers. He also showed a slide owned by Prof. A. E. Kennelly, of Harvard University, which well illustrates the work which lightning arresters are at times called upon to do.

The speaker concluded by emphasizing the advances which have lately been made in the study and production of lightning protection apparatus by the manufacturers. He urged that a more thorough study be made by operating companies of this most important question, in fairness to the manufacturers; advocated the placing of a trained gradute engineer in charge of the lightning arrester problem, its records, maintenance and improvement on each system; and contended that the moderate initial and maintenance cost of a proper equipment will in a short time be fully justified by the decreased repair bills, increased revenue and better service rendered by the apparatus protected.

FREE BAGGAGE ON THE INDIANA UNION TRACTION COMPANY

Since the beginning of the new year the Indiana Union Traction Company has begun carrying baggage free of charge. Through the courtesy of General Manager H. A. Nicholl, it is possible to give herewith some of the details of the new arrangements.

The following notice, signed by S. R. Dunbar, passenger agent, was sent out to other electric lines and to hotels and theaters in the vicinity of the Indiana Union Traction Company lines, with the request that it be posted in a conspicuous place:

On and after Jan. 1, 1906, the Indiana Union Traction Company will carry, free of charge, 150 lbs. of baggage checked on a full first-class ticket. To avoid delay of trains at stations, however, small pieces which can readily be handled by passengers in the cars will not be checked.

For baggage weighing in excess of 150 lbs. the charge will be based on the full one-way passenger fare between stations shown on ticket held by passenger, according to table below. The rate per 100 lbs. is shown in the second column, opposite the proper fare in the first column:

Full One-Way Passenger Fares	Rate Per 100 Lbs.
$0.05 to $0.60, inclusive	$0.15
0.65 to 0.80, "	0.20
0.85 to 1.05, "	0.25
1.10 to 1.25, "	0.30
1.30 to 1.45, "	0.35
1.50 to 1.65, "	0.40

Above $1.65—24 per cent of full one-way passenger fare.

The minimum charge, however, for excess baggage will be 25 cents, and no free allowance will be made when the one-way fare is less than 25 cents, but the charge will be computed on the full weight of baggage, with a minimum charge of 25 cents.

This information is tendered you for the information of the traveling public and representatives of theatrical companies.

The subject of free baggage has been receiving a great deal of attention from the traffic managers of the interurban lines centering at Indianapolis. As reported in the STREET RAILWAY JOURNAL of Nov. 25, the November meeting of the Indiana Electric Railway Association actively discussed a paper by F. D. Norveil on this subject, entitled "Shall Baggage Be Carried Free?" In his paper, Mr. Norveil, who is superintendent of the freight and baggage departments of the Indianapolis & Northwestern Traction Company, gave figures showing that while quite a large revenue was lost when his road began to carry baggage free, the increased travel resulting more than offset this deficit. At this meeting, President Brady, of the Indiana Union Traction Company, stated that his road was carrying more than 5000 pieces of baggage per month, and that the revenue was considerable.

The decision of the Union Traction Company to carry baggage free has been arrived at in the belief that the increase of travel will compensate for the loss of this revenue. The change in the method of handling baggage has necessitated special instructions to baggagemen and station agents. These are embodied in a pamphlet compiled by Mr. Dunbar, the text of which is as follows:

INSTRUCTIONS TO AGENTS AND EMPLOYEES REGARDING FREE AND EXCESS BAGGAGE

1. Agents are required to be at stations in ample time to attend to the weighing and checking of baggage before arrival of trains. They will not allow passengers to open baggage while bearing checks or remove anything therefrom. They will be held responsible for the safety of baggage while in their charge, and will be required to pay all claims arising from loss or damage to baggage through negligence on their part.

2. For passengers holding first-class tickets, agents will check free of charge personal baggage weighing not over 150 lbs. on each first-class ticket; except that hand satchels, valises, grips, etc., which are not too heavy or bulky to be handled by passengers in the cars will not be checked. Check no baggage on excursion tickets.

3. Baggage consists of wearing apparel or personal effects that may be necessary for use and comfort of passengers while traveling. Articles that may be checked are trunks, heavy and bulky valises, satchels, grips, etc. (See exception in No. 2 and charges in No. 10.) Commercial men's sample cases, tool chests, packs, etc., and property of theatrical companies. But in the case of theatrical scenery you must have it clearly understood that it is accepted only subject to delay, as it will be forwarded only on freight trains and not in passenger trains, except under special arrangements. Bicycles, baby carriages, etc., will also be checked, but are subject to special charges. (See No. 10.)

Articles that are not baggage and which must not be checked are jewelry or goods of extraordinary value, perishable or fragile goods, explosive matter, household effects, camp equipage, typewriters, calcium light tanks, bundles in shawl straps, bundles of miscellaneous articles, open baskets or bags, etc. Baggage with bundles or other articles attached, or two pieces of baggage tied or strapped together will also not be checked.

4. Passengers must present tickets before baggage will be checked. Check to no other place than to destination shown on ticket. Stamp each ticket on which baggage is checked with the rubber stamp "Baggage Checked," provided for that purpose. This will prevent the checking of baggage twice on the same ticket, as you are not to check on a ticket so stamped.

5. Do not check any baggage free when the full one-way fare is less than 25 cents. But make the minimum charge same as for excess baggage (see below) of 25 cents, and if the baggage weighs more than 150 lbs., charge 15 cents per 100 lbs. for the full weight. For example, if baggage weighed 225 lbs., the charge would be 35 cents; 300 lbs., 45 cents; 350 lbs., 55 cents., etc.

6. Excess Baggage.—Baggage weighing in excess of 150 lbs. (or baggage for points taking a one-way fare of less than 25 cents) will be considered as excess baggage, and a charge will be made for checking same. Excess baggage is computed by weight, regardless of the number of pieces.

7. Charges.—The minimum charge for excess baggage will be 25 cents. Never collect less than that. The rates are shown in the table below. To determine the charge, multiply the number of pounds in excess of 150 lbs. free allowance (see No. 5 for exception) by the proper rate per 100 lbs., always bearing in mind the minimum charge. For example, you find a lot of baggage weighs 310 lbs. and the proper rate is 15 cents, deduct free allowance of 150 lbs. and your excess is 160 lbs., charge 25 cents.

8. Table of Rates.—To determine the rate, first ascertain the ful one-way passenger fare. Locate this amount in first column of table below and in the same line in the second column will be found the proper rate per 100 lbs.:

EXCESS BAGGAGE RATES

Full One-Way Passenger Fares	Rate Per 100 Lbs.
$0.05 to $0.60, inclusive	$0.15
0.65 to 0.80, "	0.20
0.85 to 1.05, "	0.25
1.10 to 1.25, "	0.30
1.30 to 1.45, "	0.35
1.50 to 1.65, "	0.40

Above $1.65—24 per cent of full one-way passenger fare.

In computing charges, enough should always be added when necessary to make the weight and rate end in 0 or 5.

9. No single piece of baggage weighing in excess of 250 lbs. will be checked.

10. Special Charges.—The following flat rates will be charged per piece. Each article must be checked and charged for separately, whether passenger has other baggage or not, and will be checked only at owner's risk:

(a) Bicycles and tricycles, 25 cents each. But they will not be checked when there are bundles or lanterns attached.

(b) Baby carriages and go-carts, 25 cents each. But they will not be checked when they contain articles other than pillows, robes or blankets belonging thereto.

(c) Ice cream coolers, 5 gals., 25 cents; 10 gals., 50 cents; 15 gals., 75 cents.

When checking any of the above use "Excess Baggage Check" and mark thereon name of the article checked and do the same in reporting.

(d) The charge for transporting a corpse to any point on the system will be $5, except for the corpse of an infant, which be $2.50. Note: You will in no case, however, receive a corpse for transportation unless it is accompanied by a physician's, coroner's or Board of Health certificate, also an undertaker's certificate that the body has been prepared for burial and shipment in accordance with the rules of the State Board of Health; nor will you receive it with or without such certificates if fluids are escaping from the case or it has become offensive in any degree.

The transportation of a corpse dead of smallpox, Asiatic cholera, yellow fever, typhus fever and Bubonic plague is absolutely forbidden.

11. Baggage will be checked only at owner's risk to points where no regular agencies are maintained (cross-roads and stops) or where the agency is distant from our tracks. (See 12.) The company assumes no responsibility for the protection, care or delivery of baggage unloaded at these points. When checking to such points, a minimum charge of 25 cents will be made for such service. (See article No. 5, and charge accordingly when weight of baggage is in excess of 150 lbs.)

12. Stations on time-tables and tariff sheets where no agencies are maintained or where agencies are distant from our tracks are at present as follows:

Howlands, Dickeys, Smiths, Hunts, Armstrongs, Gas City Junction, Orestes, Dundee, Welsh's, Corner, Forty-Second Street, Nora, Pleasant Grove, Grays, Jackson, Fairfield, Jewell, Lincoln, Cassville and Greeves Overway.

"Double Check" (see No. 13) to all these points, as well as to all points not shown on time-tables and tariffs.

13. "Double Checking."—When checking baggage, etc., at owner's risk (see Nos. 10 and 11) pieces must always be double checked—that is, you will not give the passenger any receipt for the baggage. You will use the excess baggage check and leave the passenger's stub attached to that part of the check which is fastened to the article checked. (Conductors have instructions to remove all checks and parts of checks before unloading baggage which is "double checked.")

14. Baggage agents must examine all baggage carefully when received, and if any has the appearance of being in bad order, hinge or lock broken, they will decline to check the same unless the owner's attention is called to it and he is notified that it will be checked only at his own risk, and agents will then make notation on their books, "Received in bad order." When receiving baggage at junction, transfer and terminal points, carefuly note the condition of each piece, and if any is accepted in bad order, call the trainmen's attention to the condition of same when delivered to the train.

15. Agents will issue no checks until the baggage is in their actual possession, and will in no case check more than one piece of baggage with one check. An exception will be made to this rule in that you may exchange checks with reliable transfer or railroad companies, provided you have had written instructions from the proper officer to do so. But in all such cases be careful to explain to the owner of baggage that we assume no responsibility for damage or delay until such baggage is in our possession.

16. Baggage Checks.—(A) For both local and foreign free baggage you will use the duplicate form of check provided, showing on both portions, in ink, or by rubber stamps, never in pencil, the stations from and to which baggage is checked, together with junction points, in accordance with ticket held by passenger. In checking to foreign lines be sure to show the complete route, giving initials of each road to be traveled over, together with junction points, exactly in accordance with through interline ticket held by passenger. You will hand duplicate portion of check to passenger and attach the original to baggage by means provided.

(B) The prepaid or excess baggage check, the triplicate form, must be used whenever a charge of any kind is made for transporting baggage, whether for local or foreign excess, for transfer charges, or for single pieces going via lines which do not carry baggage free.

For excess baggage, checks must be filled out same as instructed in "A" of this section, and in addition, on each portion of check in spaces provided, must be shown in ink, the date, the amount collected, whether in cash or coupons, the net excess weight, the rate, etc.

If excess charges are collected on more than one piece of baggage belonging to the same person, a free check will be used on each of the pieces, except one, on which an excess check will be placed, which must be filled out for the entire overweight of all the pieces, and must show the number of passengers, number of pieces and the numbers of the free checks used on the other pieces. For example: If a passenger should have five pieces, four of the pieces would be checked with the free checks and the excess check would be used on the fifth piece, and should show the numbers of the other four checks.

Use one excess check for each separate collection—that is, for any one lot of baggage, checked on same ticket, use only one excess check.

In the case of special charges (see No. 10), show on each part of check the name of article checked.

When checking one piece of baggage to points on lines which do not carry any baggage free, show only the amount collected, and the complete route, stations from and to, etc., as instructed in "A."

A daily report of baggage collections made must be furnished accounting department, together with stubs of all prepaid or excess checks issued.

17. Before delivery of baggage is made to any claimant, collect and examine carefully the duplicate portion, or claim check, presented and see that the number, destination, etc., agree with the original portion attached to baggage. Send both portions of all used checks—that is, the duplicates collected from passengers and the portions removed from baggage—to the accounting department at frequent intervals.

18. Agents will keep complete record of baggage handled in the baggage books furnished, and will make such reports in connection therewith as may be required by the accounting department.

19. Agents will report to the superintendent of transportation, without delay, all complaints relative to loss, damage or delay to baggage, and will give all information possible relative thereto.

20. When (1) a check is presented for which there is no baggage, or when (2) a duplicate check calls for a piece of baggage which does not belong to the passenger, notify the superintendent of transportation at once, giving as complete description as possible of baggage wanted, and any marks thereon, and state when and where baggage was checked, what route traveled over and where last seen. Also give numbers, kind and description of the checks. In the second case (2) be particular to describe the baggage which had the wrong check on it and hold the same for instructions.

21. In case passengers have lost their checks or excess baggage receipts, require them fully to identify their baggage by describing the principal contents and produce the keys and open it. If satisfied that the claimant is the owner, take receipt on blank, Form 268, with full name and address, collecting 50 cents for the lost check, and send the baggage check, receipt and money to the superintendent of transportation.

22. When baggage is claimed by parties holding mismatched checks, agents will proceed as directed by No. 21, except that the mismatched duplicate check will be collected instead of the 50 cents, and the mismatched checks and receipts forwarded to the superintendent of transportation.

23. You will closely watch and place in the baggage room all baggage, mail or company's supplies, or other articles, as soon as received; never leave baggage, mail or supplies on the platform without carefully watching them. You will receive and protect all unchecked baggage sent to your depot by passengers with the same care as checked baggage received from trains. Care should be exercised in the handling of baggage and to protect it from the weather and theft, especially small pieces, which are liable to be carried away by mistake or otherwise. Never allow owners of baggage, express men, hack men, porters or any person to take checks from baggage, but attend to the delivery of all baggage yourself, and know that the checks are properly matched before the baggage is delivered. No person should be allowed in the baggage room except on business; the windows and baggage room doors should be securely locked during your absence.

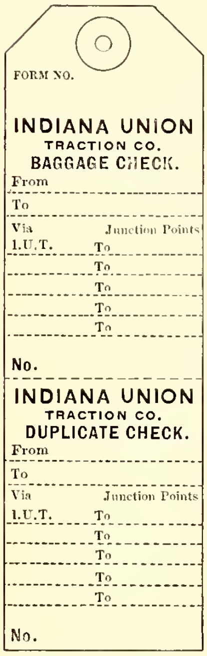
24. Storage of Baggage.—On each piece of baggage, whether inbound or outbound, checked or not checked, remaining at any station over 24 hours, storage will be charged as follows:

The first 24 hours, free; the second 24 hours or fraction thereof, 25 cents; and for each succeeding 24 hours or fraction thereof, 10 cents.

Exceptions.—Baggage received any time Saturday will be held until midnight on Monday, without charge. This exception will also apply to all legal holidays.

25. Agents will give storage charge receipt, Form 267, to passengers from whom such charges are collected, sending one copy of same with their reports.

26. Payment for local excess baggage will be accepted in coupons of the interchangeable coupon books and the I. U. T. mileage books. Tear out one 5-cent coupon from the coupon book for each 5 cents of charge, and tear out 4 miles from mileage book for each 5 cents of charge. In either case passenger must sign on back of torn out portion, and you will show on backs data of charge and collection, including check numbers. Send in detached coupons with daily report to accounting department. But all collections for foreign lines must be in cash.



FREE BAGGAGE CHECK, WITH DUPLICATE STUB

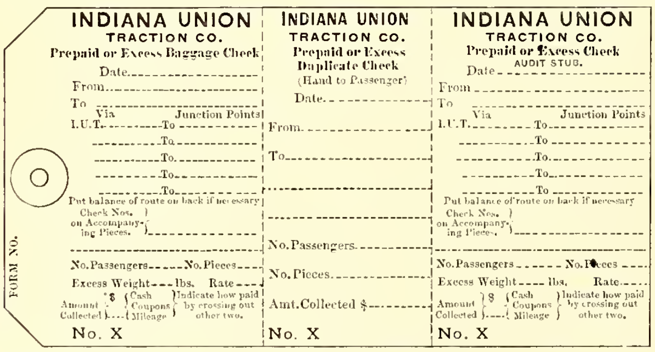
27. Agents having no scales will estimate the weight of baggage as closely as they can, and to check their estimates, if possible will ascertain weights from incoming checks, or from previous forwarding agent by telephone, or even from the passenger direct.

Agents are particularly required to ascertain the name of the real owner of each piece of local excess baggage to be checked, and not allow the company to be imposed upon by individuals who aid each other by endeavoring to procure checks for certain pieces of baggage not their own.

28. It will be the imperative duty of the forwarding agent to weigh all excess baggage and collect the full tariff rates on same, as he will be held personally responsible and be required to pay for any discrepancy.

29. It is the duty of agents to know that all men in their employ having any connection with the handling or checking of baggage at their stations are thoroughly familiar and comply strictly with the foregoing rules, as no excuse on account of ignorance of these rules by an employee will be accepted.

Concerning the basis of charging for excess baggage, Mr. Dunbar states that a charge of 24 per cent per 100 lbs. of the regular fare gives the same rates as usually charged on steam roads. These usually make a charge of 12 per cent, but as the



PREPAID OR EXPRESS BAGGAGE CHECK, WITH PASSENGER'S AND AUDITOR'S STUBS

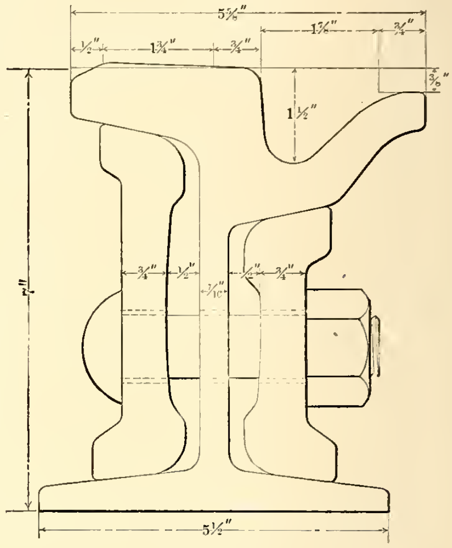
fare rates are about double those of the traction company, it was necessary to double the percentage charge on the electric line.

Two kinds of baggage checks will be used. The free baggage is of manila paper, being in much the same form as steam road checks. Attached to the excess baggage check is an audit stub and a passenger's duplicate check. In order to avoid making the check inconveniently long, the printing is horizontal instead of across the check. In addition to the routeing, this check must be filled in with the amount of excess baggage collected and the manner in which the fare was paid. To distinguish it readily, the excess check is printed on a red card.

Practically all of the cars used in regular passenger service are provided at present with combination baggage and smoking compartments. The cars in limited service, however, have no facilities for carrying baggage. The baggage of a passenger on these cars will be sent on the preceding regular car or the one following.

TYPE OF RAIL USED IN MEXICO

W. W. Wheatly, president of the Mexico Electric Tramways, Ltd., has just adopted as the standard rail for the city lines in the City of Mexico that shown in the accompanying engraving. This rail has just been brought out by the Lorain Steel Company, and was shown for the first time at the Philadelphia convention. It is called "114 No. 393," and weighs 114 lbs. per yard.



NEW TYPE OF RAIL USED IN MEXICO CITY

As will be seen, the head bears a very close resemblance to the head of the Philadelphia standard rail, but the Mexican rail is only 7 ins. in height. It will also be noticed that the head is large enough for an M. C. B. wheel. This was an important requirement for the Mexican roads, as it will enable the company, if necessary, to haul the standard steam cars over its lines. At present an immense amount of general building construction is going on in the City of Mexico, although the cartage facilities are very poor, as they consist for the most part of the old style two-wheeled native cart. It is thought that the ability to haul steam railroad cars loaded wih construction material directly over the electric railway tracks to any part of the city will prove a great convenience to those engaged in erecting buildings. At the same time, the long lip and the general "Trilby" form removes any objection which might be raised against the rail as an obstruction to traffic.

A recent consular note from Sweden states that the Helsingborg-Raa-Ramlösa Railroad (5 miles) is now being changed to use electric power. A power station is under construction in Helsingborg. The power is obtained from three suction gas motors, each of 100 hp, with peat as fuel. The power station is built by a Swedish firm which has the patent rights on said motors, which are said to be very economical in use. The owners of the Gothenburg-Särö Railroad (14 miles) have called for and received plans for the adoption of electric power for that road. The intention is to take the power from Yngeredsforsen, near the city of Falkenberg, by high-tension transmission, with a transforming stations about 6 miles from Gothenburg. Three or four new short electric railway lines near Gothenburg are also planned. It is reported that the cities of Skara and Lidköping and certain companies are negotiating for electric power from Vargöns Aktiebolag at Trollhättan. The plant shall, to begin with, have a capacity of 1500 hp. The Board of Finances for the city of Lund has in a communication to the City Council recommended the building of an electric power station in that city, and the so-called committee of electricity has recommended that the city should build electric street railways which should take the necessary power from the said power station.

THE SCHENECTADY MEETING OF THE NEW YORK STATE ASSOCIATION

The first quarterly meeting of the Street Railway Association of the State of New York, held at Schenectady, Jan. 10, was an unqualified success. About seventy-five delegates from electric railway companies in New York State, Canada, New Jersey and Pennsylvania were present. The meeting was called at 10 o'clock in the morning, and, with the exception of a short recess for luncheon, the session continued until evening. The entire day was devoted to discussions on car inspection, car cleaning and maintenance. It is safe to say that in the freedom with which detail figures and statistics of costs were exchanged, opinions expressed and information given, this meeting stands pre-eminent in the annals of electric railway gatherings and conventions.

The following is a brief extract of the papers and discussions. The complete verbatim proceedings will be printed by the association in pamphlet form, a copy of which will be sent to each person who attended the conference:

President Danforth, on opening the meeting, expressed his pleasure on seeing present so many members of the association, as well as guests. He hoped that the discussion on the topics to be taken up would be of benefit to all, and that the delegates would return to their homes with the feeling that they had gained data well worth the trouble and expense they had undergone to enable them to attend the meeting. The problems to be considered were of a purely practical character, namely, methods of car maintenance and inspection that would reduce the cost of these items to a minimum and at the same time satisfy the public by having less cars pulled off the line every day on account of some breakdown which could have been avoided by proper attention to the rolling stock while in service during the day. He invited those present not to be backward about giving out detail figures of operation, saying that they would not be accessible for general distribution, going only to those companies which are members of the association or outside companies which, by sending representatives to the conference, had shown their willingness to cooperate in this interchange of statistics.

Upon the conclusion of President Danforth's address, the secretary read a letter of welcome from the Schenectady Railway Company, extending the courtesies of the road to the visiting delegates. The Schenectady Railway Benefit Association also sent a hearty invitation through E. F. Peck, general manager of the Schenectady Railway Company, asking the delegates to attend a smoker and athletic entertainment at the rooms of the society on the evening of Jan. 11. In addition to these communications, letters of regret for inability to attend the conference were read from W. Caryl Ely, president of the American Street & Interurban Railway Association; H. H. Vreeland, president of the New York City Railway Company; F. L. Fuller, vice-president and general manager of the New York & Queens County Railway Company, and many others. The president then called upon D. F. Carver, general superintendent of the Rochester Railway Company, to read a paper on "Lay-Over Inspection vs. Night Inspection."

In his paper, Mr. Carver described an experiment now being carried out by the Rochester Railway Company on one of its lines on which inspection of cars is to be done between trips instead of at night. The paper described in minute detail the method adopted, and was replete with figures and statistics taken from the company's records, giving the cost of getting crippled cars into the car house, cost of repairs to cars in detail, cost of making inspections and other statistical data in regard to costs. The author's conclusion indicated that trip inspection, while somewhat more expensive than night inspection, will give much more satisfactory results in every way, providing certain required conditions of construction and operation favorable to trip inspection are present or can be attained at reasonable cost.

Upon the conclusion of Mr. Carver's paper and some supplementary remarks in which he gave further detail figures, President Danforth presented a résumé of the facts he had gained recently on Cleveland practice in layover inspection. He gave the exact number of cars operated, the number of car cleaners, car washers, inspectors and employees for making minor repairs, from which it appeared that, taking the whole number of cars and layover inspection employees into consideration, one man was required to look after 4.3 cars. The sentiment in Cleveland seemed to be that while this was a large organization for trip inspection work, the cost was more than made up by the reduction in maintenance expenses, as little chance was left open for the occurrence of break-downs, and less cars were pulled in than where the rolling stock is kept going for 18 hours a day without inspection.

The secretary read a letter from Paul Winsor, chief engineer of motive power and rolling stock of the Boston Elevated Railway Company, outlining the day inspection practice in Boston.

Mr. Harvie, electrical engineer of the Utica & Mohawk Valley Railway Company, said that it might be of interest to the members of the association to learn something of layover inspection on interurban lines. Formerly, when several crews were used on one run, his company found that the cars were not kept in the best shape. During the last year, however, a regular inspector was appointed to look over the cars when they enter the terminal for 15 minutes' layover. The conductor goes through the car to pick up papers, rubbish, etc., the motorman examines the controller, while the inspector takes care of the trucks and makes minor repairs, such as putting in a new trolley wheel, replaces marker lamps, or even a pole or wheel. These he has time to prepare for installation during the one-hour intervals between cars. The inspector does little oiling, lubrication being generally required but once a day. This arrangement has been found very satisfactory. In conclusion, Mr. Harvie told how much his company was paying its inspection and repair men.

Mr. Maize, master mechanic of the Rochester Railway Company, explained his company's method for keeping track of the maintenance cost per mile of the various types of field and armature coils used in Rochester, giving detail figures in connection therewith. He also spoke fully on the Rochester Railway Company's car-cleaning practice, giving the number of cars, employees and wages paid for the work.

Mr. Clark, master mechanic of the 146th Street car house of the New York City Railway Company, said he was very much interested in car inspection, but the point was—are the cars really inspected. In none of the preceding speakers' remarks had anything been said about the inspection of brake rigging. By going down into the pit himself he had often found troubles overlooked by the pit men. While the inspector may be depended upon to look for proper armature clearance, examine the controller fingers, commutator and brushes, he often neglects the brake-pin, which is a fruitful cause of accidents. The brake-staff and chain are also worthy of careful attention. Many master mechanics would find that an occasional trip to the pit would bring excellent results in keeping the repair force up to the best efficiency.

W. R. W. Griffin, superintendent of the Rochester & Eastern Rapid Railway Company, said that his inspector was a practical shop men, who had to make out a signed card for every inspection made by him. The cars are completely overhauled every three months. He agreed with Mr. Clark that more attention should be paid to details of inspection, such as connecting pins and brake rigging.

Frederick H. Beach, of the Ballston Terminal Railroad, wanted to know the causes of black spots on commutators, and how to prevent their formation. Nelson Graburn, master mechanic of the Montreal Street Railway, replied that his company had decreased this trouble 35 per cent by substituting rolled for drop-forged commutator bars. There was a saving of 30 per cent in wear in favor of the rolled bar. Mr. Graburn also gave some figures on the relative costs of both types of commutator bars. Fred. Du Bois, master mechanic of the Syracuse Rapid Transit Company, said that he had overcome the same trouble by changing the type of the brush. F. H. Lincoln, assistant general manager of the Philadelphia Rapid Transit Company, said he had also found a change of brushes satisfactory, and especially when the motormen were changed at the same time, his company having found that lazy motormen were responsible for commutator troubles by putting too much work on the motors by dragging the brake-shoes, sudden starts and stops, etc. Geo. C. Graham, superintendent of car equipment of the International Railway Company, said that in Buffalo more trouble had been found with the commutators on the cars using electric braking than on other cars, so that it would seem that electric braking is also responsible for commutator troubles.

Mr. Harvie, of the Utica & Mohawk Valley Railway Company, referred to the subject of car inspection costs, and gave the time of layovers, wages and working time of employees on his road.

H. A. Benedict, electrical and mechanical engineer of the United Traction Company, of Albany, N. Y., told how, when the rolling stock of the company was increased in weight by the addition of vestibules, and the old Westinghouse 12-a, 30-hp motors were unable to carry the greater load, he put in new strap-wound field coils with asbestos and mica insulation. These changes have raised the motor to practically 40-hp capacity.

L. L. Smith, master mechanic of the Schenectady Railway Company, asked how effective mica had been found in correcting commutator trouble. He mentioned a prominent railway motor which had given some trouble in this respect. The commutators were turned, to no avail, but the experiment was tried of changing the brushes and using grooved mica.

C. B. Fairchild, Jr., secretary of the association, told of a handy shop kink in Toronto. The practice has been adopted there of painting the car number on the bottom of the car, so that the pit men are not obliged to go out of the pits and walk along for a greater or less distance to find the number of the car on which they are working. This has been found to avoid errors in the car records. Another Toronto kink is to stencil at the end of the truck the number which indicates the man who overhauled that end of the car. The repair-pit men are all given numbers, the odd-numbered men working on motors Nos. 1 and 3, and the even-numbered on motors Nos. 2 and 4. This method, of course, quickly fixes the responsibility for the repair work done, thereby making the men more careful.

Mr. Graham, of Buffalo, said his company's practice was to put two men on repair work, holding the higher-priced man responsible for the work done by both.

Mr. Lincoln, of Philadelphia, outlined the Philadelphia Rapid Transit Company's organization methods for following up the nature and amount of repairs on each car. The inspector's report covers the name of the line on which the car was pulled in, the number of the car, the type of equipment, cause of trouble, what was done to remedy it, and if the trouble is of such character that the repairs cannot be quickly made, the car is sent to the regular repair shops. By keeping such exact records of each motorman's work and making comparisons, the company has been able to find out if cars had to be pulled in on account of ignorant or malicious handling, and the motorman is disciplined accordingly. In the grease-lubricated motors it was found that the grease would get on the commutator and into the segments, but this trouble was reduced to a minimum by having men clean the commutator ends carefully and keep them clean. Each month a statement is sent out to all of the company's car houses giving complete details of all the cars pulled in during the month. This custom has led to a healthy rivalry among the shops to see which can present the best monthly record.

L. L. Smith, master mechanic of the Schenectady Railway Company, then read a paper on "Operating Conditions as Affecting Car Cleaning," in which he outlined an original and valuable scheme for plotting in diagrammatic form records of number of cars in operation at each hour of the day. He gave graphically, by means of charts, the total cost of cleaning cars and the cost per 1000 car-miles on the Schenectady Railway. The method of plotting the records as well as the data given aroused great interest and valuable discussion.

In connection with Mr. Smith's paper, President Danforth presented some detailed statistics on car-cleaning costs gathered by him from certain lines in Michigan. He compared these figures with those current in Rochester and other New York cities, and pointed out how the difference in operating conditions necessarily affected the cost of the various items.

J. H. Pardee, general manager of the Rochester & Eastern Rapid Railway Company, said that in running interurban cars through the country they appeared to gather tiny specks of grease on the varnish, which are very hard to remove. C. S. Banghart, master mechanic of the New York & Queens County Railway Company, said that in his experience, the way to remove such grease spots without injuring the varnish was to wash the car with castile soap about once every 5000 miles.

President Danforth asked if castile soap was a better preservative for varnish than linseed oil soap. Mr. Clark cited his car-washing experiences in Pittsburg, which city, on account of its smoky atmosphere, is exceptionally hard on paint and varnish. After many experiments, he adopted what is known as Pennsylvania Railroad car-cleaning soap. With regard to the question about linseed oil soap, one of the delegates said that in his experience such soap will give trouble unless the men using it are very careful in washing it off. He had also tried castile soap, and was now experimenting with still another car cleaner. If the soap is not thoroughly removed from the car body, he found that it would destroy the varnish in a short time. H. H. Collins, master mechanic of the Fonda, Johnstown & Gloversville Railroad, said that he used a linseed oil preparation, which tends to preserve the varnish, and a neutral oil soap is used for inside cleaning. C. Gordon Reel, vice-president and general manager of the Kingston Consolidated Railway Company, also gave some data regarding his company's car-cleaning preparation. Mr. Benedict, of Albany, said his road used nothing but water and a sponge, but that the cars received this treatment every night. Remarks were also made on this subject by other delegates whose companies are testing certain proprietary articles.

The discussion on car cleaning naturally brought up the question of car painting. The consensus of opinion seemed to favor yellow for city service, both for its durability and ease with which new panels can be matched. The International Railway Company, however, favors a dark green for city service, but will retain the yellow for interurban cars, largely on account of the advertising feature and the fact that a yellow car can be more readily seen at a distance.

Mr. Pardee asked if there was any method of dry cleaning car windows during layovers. Mr. Collins, of Gloversville, stated that his company wipes the windows after each trip with dry waste.

The subject of lubrication was next discussed, and several representatives gave the cost of lubricating per 1000 miles on their roads. The consensus of opinion seems to be that oil is the proper lubricant, but no entirely satisfactory lubricating device has yet been developed. Records were also presented on the life of bearings and armatures.

The conference then adjourned for buffet luncheon, which was served in the billiard room of the Schenectady Railway Mutual Benefit Association.

After lunch the subject of lubrication was continued. Mr. Clark, of the New York City Railway, spoke at length on the necessity for using just the right quantity of oil and putting it where it would do the most good. He described a novel type of oil cup that he had devised.

The subject of life and cost of trolley wheels was then taken up, and several representatives gave their records and described methods by which they had reduced the cost of wheels per 1000 miles. It was pointed out that the type of trolley base and the tension maintained on the pole have a great deal to do with the life of trolley wheels.

Discussion was next started on maintenance, and comprehensive data were given on the cost of maintenance of different types of motors per 1000 car miles under various classes of service. A number of suggestions were made as to methods of reducing cost of maintenance on motors. Mr. Danforth stated that a road in Pennsylvania had kept accurate records for a number of years as to the saving by scraping old motors and buying several new motors each month, and charging these to maintenance of equipment account.

Then followed an exchange of experience on brake-shoes.

The remainder of the afternoon was devoted to discussion on brake hangers, controller troubles, axles, flat wheels and other topics and the costs of maintaining these parts on several roads were given.

A resolution was passed authorizing the president to appoint a committee of five, consisting of the president, the secretary and three mechanical members, to collect statistics on maintenance of equipment, and present them to the association. It was also decided to prepare a list of items concerning which each member could keep records on his respective road, so that better comparisons can be made in the future.

The meeting then adjourned.

SINGLE-PHASE LOCOMOTIVE IN SWEDEN

Experiments are being conducted on the Swedish railways at present with single-phase, 25-cycle current for traction. These tests are made with a view of introducing later on single-phase traction in general on the Swedish railways, since Sweden is rich in water power, but not in fuel. Two locomotives and two motor cars have been ordered, partly from the Allgemeine Elektricitäts Gesellschaft and the Siemens-Schuckert Works, in Berlin, and partly from the British Westinghouse Company. Single-phase commutator motors are used throughout. One of the German papers had an extended article recently on the locomotive furnished by the Siemens-Schuckert Works. It has a weight of 36 tons, and is intended for freight trains with speed up to 45 km (28 miles) per hour on a level road and about 24 km (15 miles) per hour on grades of 1 per cent. By changing the ratio of gearing, it is intended to increase the speed later on to 65 km (40 miles) per hour. The locomotive has three driving axles, each being driven by a compensated series motor of similar design as those used on the Murnau-Oberammergau single-phase road. The normal capacity of the 320-volt, 25-cycle motors is 110 hp, and with the ratio of gearing of 1 to 5, which is used at present, the maximum tractive effort of the three motors is 6000 kg (13,200 lbs.) at the wheels. In the front of the locomotive a transformer is placed with a normal capacity of 300 kva., the primary of which consists of a series of windings, the connections of which may be changed so that the voltage supplied to the primary may be varied between 5000 volts and 20,000 volts. One of the chief purposes of the tests is to find the highest voltage with which a safe and satisfactory traction service can be maintained. The voltage of the secondary of the transformer can be varied between 160 volts and 320 volts. A controller contains ten positions, of which the first one is intended for very slow speed, and a special device for blowing out magnetically the spark due to the short-circuiting of coils. The motors are artificially cooled with air. The locomotive has two aluminum bows for taking off the current from the trolley wire.

REORGANIZATION AND REJUVENATION OF AN IMPORTANT BRUSH MANUFACTURING COMPANY

The Le Valley Vitæ Carbon Brush Company has recently been reorganized and important changes, both in factory and office organization, have been made, with a view of improving the company's manufacturing methods and general service to patrons. It will be remembered that this company is one of the oldest in the country which has given special attention to the manufacture of carbon brushes for electrical apparatus, and that it was built up and enjoyed a large and successful business under the management of the late John V. Clark. Mr. Clark died about a year and a half ago, and following his death there was a period during which there was a disruption of the organization and no definite management. Realizing the importance of maintaining the business and reputation which had been established by her husband during so many years, Mrs. L. C. Clark, the widow of the former head of the concern, decided to take personal charge of the business, and as she possessed good executive ability, and as she was thoroughly conversant with the details of the business during her husband's life, she is well fitted to conduct its affairs. At the time she took charge, she decided to increase the field of action of the company. She has placed it on a strong financial basis, and plans are now being perfected for prosecuting by far the most extensive and aggressive campaign of publicity ever employed by any concern in a similar line.

Mrs. Clark possesses the distinction of being one of the very few, if not the only woman, who is conducting the affairs of an important electrical manufacturing company, and the indications are that she will succeed in making the Le Valley vitæ carbon brush better known and better in quality, if possible, than ever before.

REFUNDING FARES TO BUFFALO

Out-of-town customers of the firms which are members of the Retail Merchants' Board of the Buffalo Chamber of Commerce are refunded the fare which they pay in traveling to Buffalo to do their shopping. One round-trip railroad, steamboat or trolley fare from any city or town within a radius of 40 miles of Buffalo is refunded to each individual whose purchases from any or all of the firms shall amount to at least the sum of $25. Round-trip fare is likewise refunded to any person who comes from a point within 80 miles and over 40 miles of Buffalo whose total purchases amount to at least $50. Persons living at a greater distance than 80 miles have their fares rebated. To illustrate: If one lives 100 miles away he pays for only 20 miles, and the association pays for 80 miles both ways. When a rebate book is applied for, before it is issued, the customer must show his or her return ticket, and the ticket is then stamped on the back with a star. Customers are requested to apply for rebate book at the store where first purchase is made. Fares are refunded on rebate book after ten days from date on which the book is issued. No rebate is allowed unless application for same is made at time of purchase. The purchaser of the required amount of goods must apply for refund at the office of the secretary, Room 39, Chamber of Commerce Building, Seneca Street, which is open from 9 a. m. to 5:30 p. m.

THE CONSTRUCTION OF MODERN AMUSEMENT PARKS

The railway park, which had its origin in the small grove tenanted by merry-go-rounds and popcorn stands, has been developed within recent years to the point where it requires the attention of the specialist in the art of providing entertainment for the masses. A study of some of the parks built within the past two or three years shows how easily profitable traffic can be created if the amusement grounds are properly located and furnished with suitable attractions. In presenting the accompanying illustrations and descriptions, it is desired to give some characteristic examples of parks and park attractions which have proved profitable sources of income to the electric railways in their respective territories. The work shown was carried out by Edward C. Boyce, Inc., of New York, which firm designs, constructs and operates amusement resorts, either as independent enterprises or as a park adjunct to the business of a transportation company.

FIG. 1.—NIGHT VIEW OF THE "WHITE CITY," NEW HAVEN, CONN.

FIG. 2.—ENTRANCE TO THE "WHITE CITY," AT NEW HAVEN, CONN.

FIG. 4.—A CROWDED DAY SCENE IN THE "WHITE CITY," CHICAGO, SHOWING THE GREAT POPULARITY OF THE OPEN-AIR CIRCUS

In a recent interview on the subject of amusement parks as an investment, Edward C. Boyce, the president of this company, said to a representative of the Street Railway Journal:

"The chief factor in making possible the remarkable progress which has been made is the modern street railway system or trolley. Prior to its introduction on an extended scale it was physically impossible to transport large numbers of people to any given point with comfort, speed, and at nominal expense. By the complete solution of these difficulties the success of amusement resorts has been made possible, and some idea of the magnitude and profit of such enterprises may be conveyed by the fact that one resort, erected during the season of 1905, cost a little over $600,000 and returned a net profit of close to $500,000 as a result of its first season's operation. A number of new amusement parks for various traction companies are being built for the coming season. The success of last season has convinced these companies that not only is the modern amusement park a safe, sound and very profitable investment, but it does more to increase summer traffic than any other medium known. One may safely predict that within the next few years every large company will arrange to have along its lines a complete resort operated by a single individual or corporation."

A striking feature of all the parks built by the Boyce Company is their artistic and elaborate illumination. As a general rule, most of the patrons of "built up" parks come at night, and it has been demonstrated over and over again that nothing is more effective for attracting visitors and keeping out undesirable persons than plenty of light. The installation of parks of this kind should be especially attractive to railway companies, because they have the facilities to produce current more cheaply than could be done if a separate plant is erected at the grounds for use three or four months a year, and consequently they can afford to be more liberal in providing for suitable lighting effects.

An example of what good judgment and experience can do in this regard for a park of moderate size is shown in Fig. 1, which is but a faint reproduction of the central tower and part of the grounds in the "White City," New Haven, Conn., as seen at night. This park has become a very popular resort, and has shown that places of this character can be made a success, even in small towns, where good returns can be secured only by the continued patronage of the same people. The imposing entrance to this park is shown in Fig. 2, while Fig. 3 gives an excellent view of the arrangement of the various attractions. The high column seen at the left of Fig. 3 is the main lighting tower, which was nearing completion at the time the picture was taken. Additional attractiveness is lent to this park by the large garden plats placed here and there, and the background of trees, whose quiet green forms a pleasing contrast to the white show structures. Among the installations embraced in this view are a dancing pavilion, fairy theater, a large lagoon used in connection with shoot the chutes, miniature railway, tower, part of a circle swing, restaurant, etc.

FIG. 3.—GENERAL ARRANGEMENT OF THE ATTRACTIONS IN THE "WHITE CITY," NEW HAVEN, CONN., SHOWING THE "SHOOT-THE-CHUTES" POOL, THEATER, CAFE, DANCING PAVILION, TOWER, MINIATURE RAILWAY, GARDEN PLATS, ETC.

Another example of a well-designed amusement ground is the "White City," in Worcester, Mass., of which a general view is presented in Fig. 5. It will be noticed that this park also has a lagoon in the center with a shoot the chutes, the usual attractions being in artistically designed buildings placed around the water, but at a distance great enough to allow room for a boardwalk between the lagoon and the buildings.

One of the most conspicuous successes in the amusement field during the past year was the "White City" opened last season in the South Side district of Chicago. Despite the fact that this park is located several miles away from the center of population and has no aquatic sports of any kind, its up-to-date attractions and splendid illumination led many Chicagoans of the distant North and West Side districts to go to the "White City" in preference to other parks much nearer to them. In addition to the numerous enclosed shows at this resort, the park management provided a fine open-air circus which was very popular, as can be seen by looking at the great crowds shown in the engraving. This illustration, which was taken during the day, when the patronage is much less than at night, shows how well the new park must have been patronized. Like Dreamland, Coney Island, the "White City" has a brilliantly illuminated tower visible for miles around and sure to excite the admiration and curiosity of all who see it.

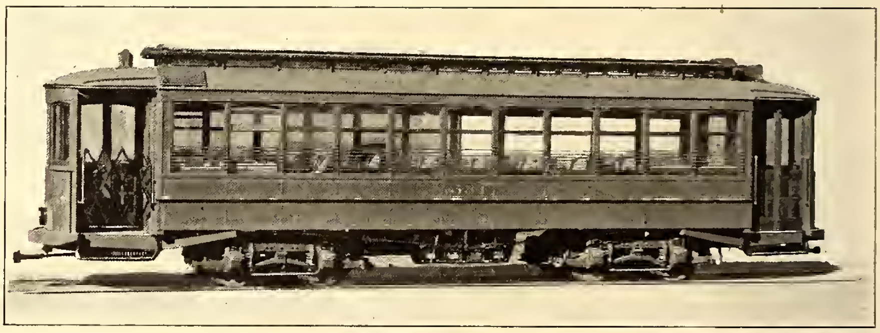
FIG. 5.—A GENERAL VIEW OF THE "WHITE CITY," WORCESTER, MASS., WITH CENTRAL LAGOON

Besides the design, construction and operation in their entirety of parks of this character, the Boyce Company gives much attention to designing and installing amusement specialties. These are so many in number that lack of space prevents more than a brief mention of some of the more important ones. Among the latter are "Canals of Venice," a miniature reproduction of the Queen of the Adriatic, requiring the installation of ¼ mile of winding canals which flow by the famous plaza of St. Mark, Palace of Doges, Rialto Bridge, Desdemona's Palace, Bridge of Sighs, etc.; "Great Coal Mine," giving an instructive trip through an imitation coal mine; "The Bumps," consisting of a hardwood incline full of unsuspected knobs and depressions, which cause the sliders to assume the most ludicrous positions, much to everybody's amusement; a "Shooting the Chutes," which is equipped with a moving stairway to carry the passengers from the bottom to the waiting platform at the top; "Circle Swing," a device consisting of a central pole around which torpedo-shaped boats are arranged to swing, remaining at all times in perfect equilibrium no matter how unequally the load is distributed; scenic railways; figure-eight roller-coasters, etc.

Each employee of the Boston Elevated Railway who on Jan. 1 had been in the service of the company six months or longer and possessed a satisfactory record was given $15 in gold.

SEMI-CONVERTIBLE CARS FOR THE MEMPHIS STREET RAILWAY COMPANY

The John Stephenson Company, of Elizabeth, has delivered to the Memphis Street Railway Company thirty-five double-truck cars of the semi-convertible type built under the Brill patents and mounted on Brill No. 27 GE-1 trucks. The new cars were ordered on account of a new extension for the system which has lately been completed. Within the past year the company has had twelve single-truck closed cars from the American Car Company and twenty double-truck open cars from the G. C. Kuhlman Car Company. Memphis has over 100,000 population and is the chief commercial point on the Mississippi River between St. Louis and New Orleans. The population is increasing rapidly, and the railway company has aided in the development of the city and its environs by many improvements in its equipment besides the additions to the rolling stock. These cars are quite similar to the double-truck semi-convertibles with which the Nashville lines are equipped.



ONE OF THE NEW DOUBLE-TRUCK, SEMI-CONVERTIBLE CARS FOR MEMPHIS, TENNESSEE

The new cars are handsomely finished in mahogany with bird's eye maple head linings, and the seats are of the walk-over type upholstered in spring cane. Although the climate at Memphis is comparatively mild during the winter, the rainfall is heavy and the vestibules will be much appreciated. With windows which can be raised entirely into roof pockets the cars are always ready for any kind of weather. Seven-bar bronze window guards prevent passengers from putting their arms outside the windows. The bottom framing is of the substantial form usual with this type, and besides having 12-in. x ⅜-in. sill plates, the inside of the sills has under trusses with queen posts. The outside platform knees are reinforced with angle iron and the center knees are composed of angle irons offset for the purpose and which extend well back of the body bolsters.

The general dimensions are as follows: Length over the end panels, 30 ft. 6 ins. and over the vestibules, 40 ft. 6 ins.; width over the sills, including the panels, 7 ft. 8½ ins., and over the posts at the belt, 7 ft. 11½ ins.; center of posts, 2 ft. 8 ins.; height from the floor to the ceiling, 7 ft. 9 ins.; from the track to the under side of the sills, 2 ft. 8¼ ins.; from the under side of the sills over the trolley board, 8 ft. 8 ins.; from the track to the platform step, 16½ ins., and from the step to the platform, 13⅛ ins.; length of the seats, 34 ins.; width of the aisle, 22½ ins.; wheel base of trucks, 4 ft.; diameter of the wheels, 33 ins., and diameter of the axles, 4½ ins. Four 50-hp motors are used per car. The weight of the car and trucks without the motors is 33,300 lbs., and including the motors, 45,700 lbs.

SOME RECENT INNOVATIONS IN TRANSFER TICKETS

To prevent the abuse of exchanging of round trips, W. C. Pope, vice-president of the Globe Ticket Company, of Philadelphia, has designed a novel form of transfer ticket which gives the railway using it a distinctive transfer for A. M. and P. M. use without causing any more trouble to conductors than the old-fashioned style. Although this coupon transfer

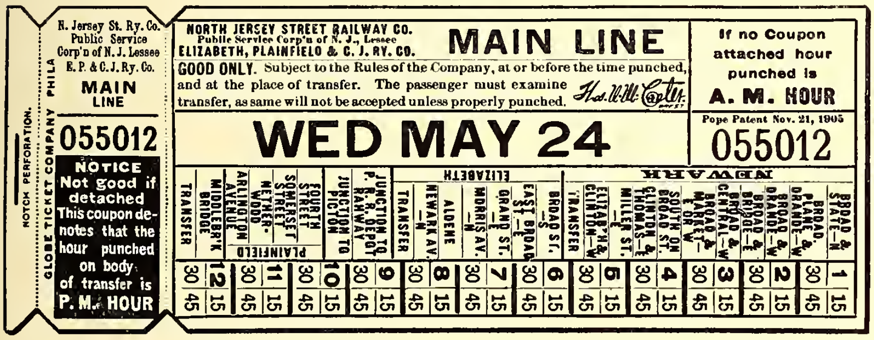


FIG. 1.—TRANSFER USED ON THE MAIN LINE OF THE PUBLIC SERVICE CORPORATION OF NEW JERSEY, WITH COUPON ATTACHED FOR P. M. HOURS ONLY

has been on the market but a few months, contracts have already been made to supply over 200,000,000 annually.

As will be seen from an inspection of the transfers reproduced in Figs. 1 to 4, all the transfers for A. M. use are issued without a coupon, and those for P. M. use with a coupon. This gives, therefore, a different appearing transfer for post-meridian and for ante-meridian. The change in length also enables the

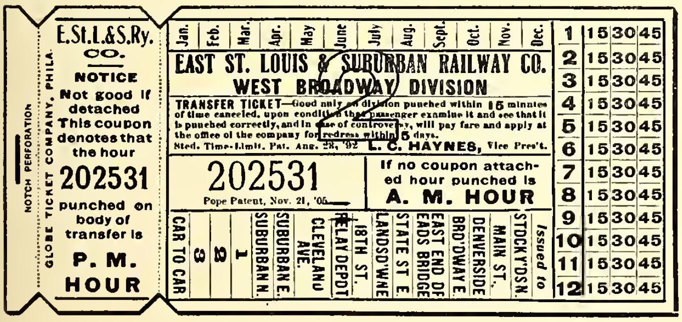


FIG. 2.—COUPON TYPE TRANSFER EMPLOYED BY THE EAST ST. LOUIS & SUBURBAN RAILWAY COMPANY

conductor to tell at a glance if the right transfer is presented. The use of the coupon is also a great help to the auditing department in checking up the transfers, all of which are numbered in duplicate, with their accompanying coupons. Should an attempt be made by tearing off the coupon, to use a P. M. transfer the next morning, it would result in failure, because every transfer is made to show the date of issue.

The successful application of this ticket to the conditions existing on a large transfer system is well shown in Fig. 1, which is a reproduction of the transfer issued on the main line of the Public Service Corporation of New Jersey. It will be noticed that the date of issue is plainly printed across the face

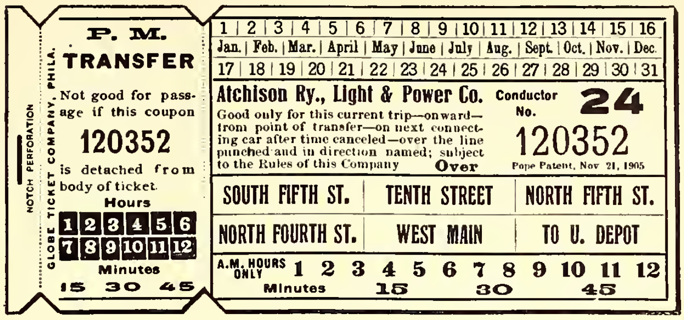


FIG. 3.—REPRODUCTION OF THE ATCHISON RAILWAY, LIGHT & POWER COMPANY'S TRANSFER, SHOWING HOURS AND FRACTIONAL DIVISIONS ON P. M. COUPON

of the ticket, making it necessary to punch only the fractional hour in the proper square and the line to which the transfer is given. The transfer shown in Fig. 2, which is used by the East St. Louis & Suburban Railway Company, has the day of the month stamped across its face, and therefore requires three punches, covering the month, fraction of the hour and the transfer line. As a matter of fact, the conductor makes the month perforation in advance, so that when issuing the tickets he is obliged to punch only for the fraction of the hour and the transfer line. The Atchison Railway, Light & Power Company's transfer, reproduced in Fig. 3, is typical of a system with few transfer points. On this ticket the conductor can make two perforations in advance, those for the month and the day, but on issuing the transfer must punch the ticket for the line on which the transfer is given, the hour and the fraction of the hour. The Topeka Railway Company's ticket, shown in Fig. 4, is practically the same as Fig. 2, except that it also indicates from what corner the transfer was given.

Another valuable innovation in transfers designed by Mr. Pope is illustrated by the time-limit tickets reproduced in Figs. 5 and 6. In this form no intricate punching of the fraction of the hour is required, the arrangement at the left-hand end of the ticket being so plain that all disputes are avoided. In the transfer reproduced in Fig. 5, A. M. and P. M. are indicated

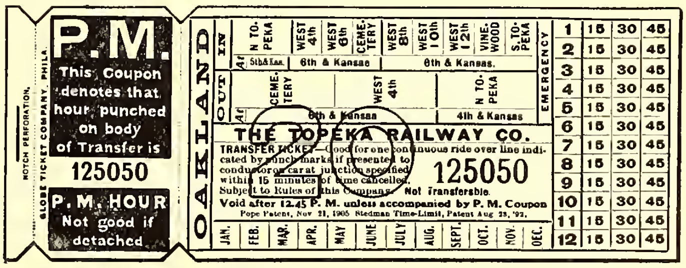


FIG. 4.—THE TOPEKA RAILWAY COMPANY'S COUPON TICKET, SHOWING ALSO POINTS WHERE TRANSFERS ARE GIVEN

by the light and dark divisions of the line to which the transfers are issued, while on the Elmira Water, Light & Railroad Company's transfer, shown in Fig. 6, the distinction is made still clearer by confining the difference in coloring to the left-hand end of the ticket, which is reserved for indicating the fractions of the hour.

These transfers are issued with the Globe Ticket Company's special holder, which will hold a pad of any number of transfers, and is so simple that no delicate adjustment is needed. The conductor detaches any number of transfers required at the proper place by sliding the pad once every 15 minutes. This

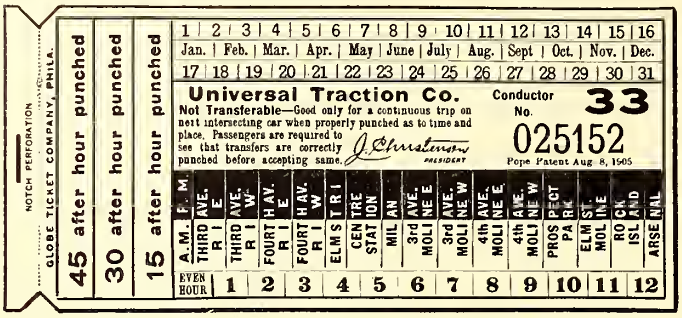


FIG. 5.—TYPE OF TRANSFER WITHOUT P. M. COUPON, BUT INDICATING A. M. AND P. M. HOURS BY THE BLACK AND WHITE DIVISIONS, SHOWING THE TRANSFER LINES

can be performed so readily that it consumes practically no time, as it is done by the thumb while taking the pad in the hand. As the pad is held firmly in place at the proper adjust-

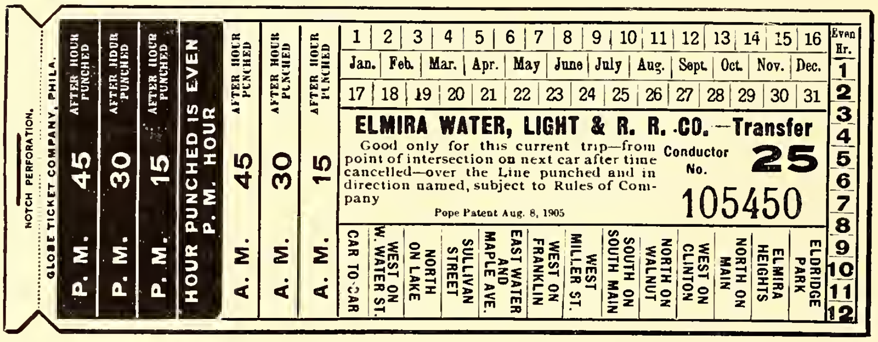
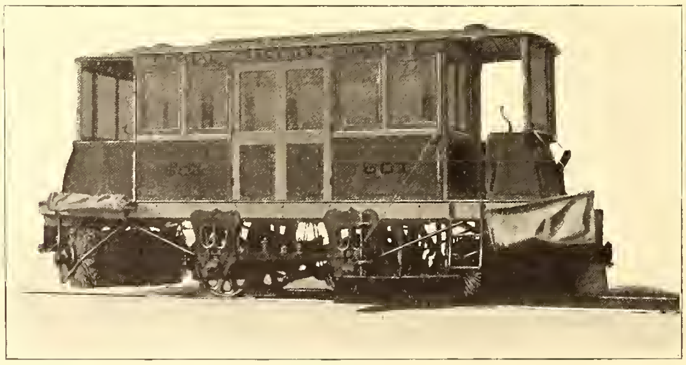


FIG. 6.—THE ELMIRA WATER, LIGHT & RAILROAD COMPANY'S TRANSFER SHOWING THE DISTINCTION BETWEEN A. M. AND P. M. ISSUES BY PUNCHING THE BLACK OR WHITE QUARTER-HOUR DIVISIONS

ment, it is impossible to issue transfers wrongly. If the holder is not needed, these transfers can be issued quite easily with an ordinary metal strip.

SNOW-REMOVING EQUIPMENT FOR CAPITAL TRACTION COMPANY, WASHINGTON, D. C.

The Capital Traction Company, of Washington, D. C., has received another snow sweeper from the J. G. Brill Company, which is similar to those which the company has used



NEW WASHINGTON SNOW SWEEPER, SHOWING THE STORM SHIELDS FOR PROTECTING THE PLATFORMS

for several years and is known as the Brill standard sweeper. A large number have been furnished to the New York City lines and other prominent systems in different parts of the country. This, however, is the first to have storm shields to protect the platforms. It is a powerfully built machine, weighing about 16,000 lbs. without motors, and has short revolving brooms at either end which are capable of a vertical adjustment up to 9 ins. from the pavement. They measure 5 ft. 6 ins. over the rattan and extend 10 ins. beyond the rail.

The builder claims another advantage in using short brooms instead of the long or double type, namely, that the brooms can be set at a greater angle and thereby throw the snow immediately clear of the track and not ahead to be handled a second time. The brushboard and wing, which extend from the broom across the track in front of the right leading wheel, remove most of the snow from that side of the car to a distance of 3 ft. or more outside the rail, and the snow that is left on the pavement is entirely cleared away by the revolving broom at the rear. The illustration of the interior of the car shows the convenient arrangement of the levers for raising and lowering the brooms and the brushboards. The motor for driving the brooms was not installed when the photograph was made. At either end of the motor shaft are casings which cover sprocket wheels and chains. These chains consist of drop-forged links manufactured by the builder. Sand boxes of the "Dumpit" type with large hoppers are enclosed in boxes and are located at diagonally opposite corners of the cab. They are operated by hand levers from the platforms.

As the illustration shows, the cab is well lighted and has double swing doors at the sides and single doors at the ends. The sash next the door at each end is arranged to drop into a pocket; the other sashes are stationary. The car measures 21 ft. over the sills and is 6 ft. 10¼ ins. wide over the sides. It is mounted on a gear truck of Brill manufacture, which has a wheel base of 6 ft. and 33-in. wheels. Two 35-hp motors are used for propulsion, and one of the same capacity for operating the brooms.

The Capital Traction Company operates about 625 cars and has over 40 miles of trackage, 30 miles of which are equipped with wires in conduits. Within the last

INTERIOR OF SNOW SWEEPER, SHOWING THE CONVENIENT ARRANGEMENT OF THE LEVERS FOR RAISING AND LOWERING THE BROOMS AND BRUSH-BOARDS

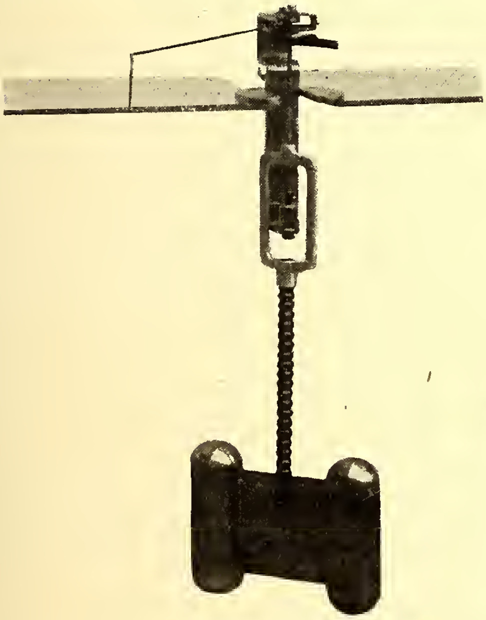
year or two the Brill Company has furnished a large number of standard open and closed cars and its convertible and semi-convertible cars to this company.

The Cleveland & Southwestern Traction Company has instituted limited service between Cleveland and Norwalk, and last week took a party of newspaper men over the line in fast time in one of the new coaches recently described in this paper.

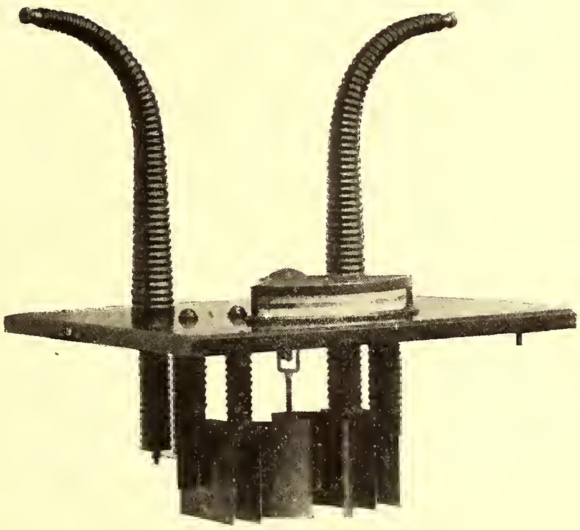
ELECTROSTATIC VOLTMETER FOR TESTING

In electrical testing and experimental work, high pressures are continually being used, and the measurement of these potentials is very often a perplexing problem. A number of different methods of high-pressure measurement have been used with varying degrees of success as to their accuracy, but all involve some uncertainty as to results. Where it is required that such apparatus as dynamos, transformers, cables, insulators, etc., be subjected to a specified pressure test as a condition of their acceptance, controversy often arises as to whether the required voltage has been applied. The ideal and theoretically correct method of high-potential measurement is that employing an electrostatic voltmeter, but certain obstacles, the principal one of which was the lack of an insulating medium of sufficient dielectric strength, have heretofore prevented the development and application of this type of instrument. The Westinghouse Electric & Manufacturing Company has succeeded in overcoming these difficulties and in producing a meter that requires for its operation a negligible amount of energy, that is free from the effects of variation of wave form, and is direct reading. The faults inherent in other methods of high-potential measurement are claimed to be entirely absent from this meter.

The operating elements of this instrument are immersed in oil contained in a metal-lined wooden case with an insulated cover. The metal lining acts as a screen to prevent outside fields or influences from affecting the meter. As the insulation is one of the most important parts of an instrument of this type, a few of the advantages derived from the use of oil may be summarized as follows:



ELEMENT IN STATIC VOLTMETER



VOLTMETER WITH CASE REMOVED

The distance between the operating elements may be greatly lessened, thereby reducing the size of the instrument; the actuating forces are greatly increased, due to the smaller distances between active parts and the high specific inductive capacity of the oil; the reduction in distance between working parts of the meter makes possible a better form of scale; the oil acts as a damper and makes the instrument nearly dead beat and easy to read; the oil buoys up the moving element, thus removing practically all weight from the bearings.

The arrangement and relative position of the parts of the meter are shown in the diagrammatic sketch. The curved plates *B* 1 and *B* 2 are of such a shape and so arranged with respect to the moving element that a deflection in a positive direction shortens the gap between it and the plates. The charges induced on the two extremities of the moving element are of such a nature that they exert forces of attraction on the charges on the plates, which bring about such a movement. The turning of the moving element is restricted by a spring and the deflection of the pointer is read on the scale. The condensers *C* 1 and *C* 2 are in series with other parts of the instrument, one plate of each being metallically connected to a curved plate and the other to a terminal. The instrument may

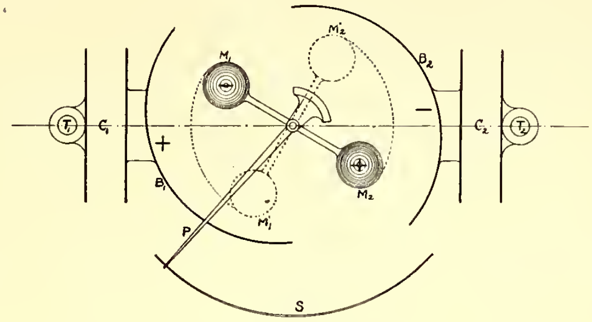


DIAGRAM SHOWING CONSTRUCTION OF VOLTMETER

be operated with either or both condensers short-circuited, thus giving a wide range to the meter.

The curved plates with the condenser plates attached are supported from the insulated cover by means of grooved posts of suitable insulating material. The separate condenser plates are supported in a similar manner. As all parts are firmly fastened to the same base, they are held in constant relation to each other, and no error can result due to disarrangement of parts. The height of the oil in the case, together with the long paths over the suspension posts, prevents leakage between the plates. The horn-shaped terminals extend to the same distance below the oil as the suspension posts, and are also grooved so as to prevent leakage over their surface.

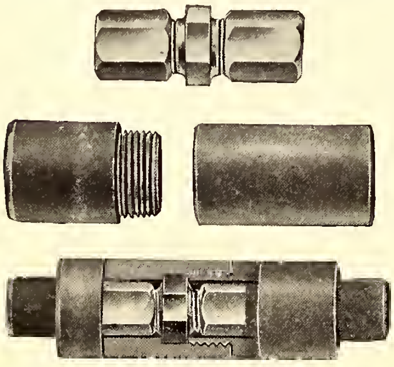
The bearing springs and adjustments are similar to corresponding parts of Westinghouse standard indicating instruments. The cylindrical parts of the moving elements are hollow and so proportioned that the buoyant effect of the oil removes almost all weight from the bearings, thereby eliminating friction and wear. The scale over which the pointer passes is placed on an edgewise cylindrical form similar to the scale of an edgewise switchboard instrument, and the reading may be taken from a safe distance. With the exception of the glass window through which the scale is read, the cover over the pointer is all metal, and acts as a screen to prevent external static fields from affecting the pointer. Instruments of this type may be obtained for potentials as high as 200,000 volts. The one shown in the illustrations may be used for voltages up to 100,000 volts with the condensers in circuit, or for approximately 50,000 volts or 25,000 volts with one or both condensers short-circuited.

In a recent rear-end collision on the Long Island Railroad, a train of steel motor cars, when going at a high rate of speed, demolished three freight cars, without damage to themselves. There were no passengers on the train.

AN IMPROVED METHOD OF CONNECTING MOTOR LEADS

The inconvenience of the present method of connecting motor leads to the car wiring has long been obvious. The length of time required to make the present connections and tape them, when added to the cost of the tape used and lost in the operation, has proven a serious item in the cost of supplies and a source of vexation to all connected with this branch of the street railway service.

To obviate this difficulty, Dossert & Company, of New York, have brought out a modification of their well-known solderless wire and cable connector, especially adapted to the use of motor leads. The accompanying engraving illustrates the connector, insulating cover and a sectional view showing how the cover is locked over the metal portion. The joint consists of a regular type A solderless connector, composed of two double beveled, split cones, two compression nuts and a nipple, the latter having a center of larger diameter than the nuts. The method of making up the connectors is as follows: The two parts of the insulating cover are separated by unscrewing and one piece is slipped over each end of the wire, care being taken to have the threaded ends toward the end of the wire. The cable is then thoroughly cleaned of insulation a little longer than the length of the nut. The nut is then backed off two or three turns and the wire inserted, after which the nut is tightly screwed back in place. After proceeding in the same manner with the other end of the cable, the insulating cover is brought down over the connector and tightly screwed together, so that there is no danger of its becoming loose. The insulating cover is made of a composition which is a perfect insulator, not readily broken, and is impervious to dampness or oil. The joint has just been put on the market and is receiving much favorable commendation.


CONNECTOR FOR MOTOR LEADS

SINGLE-PHASE LOCOMOTIVES FOR THE SARNIA TUNNEL

The important announcement was made Jan. 8 that the St. Clair Tunnel Company, which is a subsidiary company of the Grand Trunk Railway system, had awarded a contract to the Westinghouse Electric & Manufacturing Company for a complete electrical installation to operate freight and passenger trains through the tunnel under the St. Clair River, which connects the American and Canadian divisions of the Grand Trunk Railway system.

The plans and specifications were prepared by Bion J. Arnold, of Chicago, whose pioneer work in single-phase alternating-current traction is known to all engineers. The work of installation will be conducted under Mr. Arnold's supervision.

The equipment includes a complete power station, containing boilers, stokers, coal and ash-handling machinery, feed-pumps, feed-water heaters, condensers, water supply, fire protection and heating systems, piping, electric crane, steam turbine generating units, engine-driven exciting unit, motor-driven exciting unit, switchboard, feeder and distributing system, bridge and pole lines for catenary trolley construction, overhead work, bonding, transformers for power and light, light and power distributing systems, lightning protective apparatus, arc and incandescent lamps, roundhouse motors, motor-driven pumps, drainage and sewer systems for buildings and yards, and electric locomotives.

Interest centers largely in the locomotives equipped with the series-wound single-phase motors developed by the Westinghouse Company. There are to be six similar units, each of which will exert a draw-bar pull of 25,000 lbs. on a 2 per cent grade at a speed of 10 m.p.h. The locomotives may be operated from either end, and two or more may be coupled together and controlled in multiple from a single unit, so that there is practically no limit to the size of train which may be taken through the tunnel by the electrical equipment—other than that imposed by the limited mechanical strength of the coupling from car to car.

These locomotives are of the rigid frame type, with driving axle boxes and draft gear mounted on the same frame. Each unit will have three pairs of 62-in. driving wheels, with a motor on each axle connected with a gear reduction of 18 to 95. It will weigh approximately 62 tons, all of which is on the driving wheels. Equalizer beams similar to those used in standard steam locomotive practice will distribute the weight among the six drivers. The frames will be made of cast steel and will be placed outside the wheels. The locomotives will be equipped with the Westinghouse friction draft gear. The power equipment of each unit comprises three 250-hp, single-phase, series wound motors with unit-switch type, transformer-tap control. Pneumatically-operated trolleys of the pantagraph type will collect the current from the overhead catenary trolley line outside the tunnel.

The Sarnia tunnel is 6032 ft. long. A single track leads through the tunnel, but the approaches are double track up to a point about 300 ft. from each portal. From terminal to terminal, a distance of 19,348 ft., will be electrically equipped.

At the present time passenger and freight trains arriving from either direction are hauled through the tunnel by steam locomotives. Almost all of the freight trains must on arrival be divided, as they are too heavy for a single locomotive. The result has been that traffic is congested at the terminals and the entire service of the system impaired. It is expected that the electric locomotives will greatly relieve this congestion, as their greater capacity and flexibility will eliminate or largely reduce the necessity of dividing trains. Alternating current at 3000 volts, 25 cycles, will be delivered to the locomotives. Outside the tunnel the current will be fed through a No. 0000 grooved trolley wire.

POWER FOR FONDA, JOHNSTOWN & GLOVERSVILLE RAILROAD

The Fonda, Johnstown & Gloversville Railroad Company calls attention to the fact that all the power used by its cars on its own line is generated in its station at Tribes Hill, N. Y., and is not purchased from the Hudson River Electric Power Company, as might be inferred from a recent article in this paper. The Tribes Hill station, located just outside the city of Amsterdam, is one of the largest and most complete in the East, and also supplies power to the Edison Electric Light & Power Company, of Amsterdam. The station was fully described in the STREET RAILWAY JOURNAL for Aug. 29, 1903.

The employees of the St. Louis Car Company enjoyed their fifth annual New Year's banquet Dec. 30 at the company's plant in Bremen. President Kobusch, General Manager Vogel, Secretary Mills and other officers were present. The company has made it a custom to bring its employees together at this season every year and to provide a banquet of generous proportions. Addresses were delivered by officers and employees.

FINANCIAL INTELLIGENCE

WALL STREET, Jan. 10, 1906.

The Money Market

There has been a very material improvement in the monetary situation during the past week. The heavy arrival of funds from all parts of the country and from Canada, together with the return to the banks of a considerable portion of the funds disbursed for interest and dividends on Jan. 1, and the Government expenditures on account of the Panama Canal, have materially increased the supply of lendable funds, and this has been reflected in a sharp decline in the rates for all classes of accommodations, despite the continued active demand resulting from a heavy speculation in the securities market. Money on call was freely supplied, at an average rate of 6 per cent, while short-time maturities were obtainable at 6 per cent, as against 8 and 9 per cent asked at the close of last year. Six months money was offered freely at 5½ and 5¾ per cent, but there was no disposition on the part of borrowers to make contracts for that period. In some quarters a further relaxation in money rates are expected, as a result of the return movement of funds from the interior, which is now fairly under way, and which is likely to assume much larger proportions in the near future, but the opinion prevails in conservative banking circles that the market will rule at near the present level for some time to come. It is pointed out that the reserves of the New York City banks are very low, and with the strength in foreign exchange, which makes possible the shipment of gold to Paris, will prevent any material reduction in interest charges, at least for the present. A feature of the week has been the heavy demand for high-grade commercial paper at rates ranging from 5 to 5½ per cent, showing a disposition on the part of the banks to lend for mercantile rather than for speculative purposes. The amount of prime material coming upon the market, however, has been extremely small, merchants as a rule being well supplied with funds. The foreign markets have remained firm, with an upward tendency, but as yet there has been no appreciable demand in either money or discount rates at the principal European centers. The bank statement published on last Saturday was very disappointing. Instead of an increase in cash, as indicated by the preliminary figures, the banks reported a decrease in this item of more than $2,000,000. The surplus decreased $3,721,575 to $571,000, as compared with $11,608,250 in the corresponding week of 1905, $14,686,975 in 1904, $14,810,300 in 1903, $12,958,450 in 1902, $22,398,050 in 1901, and $11,757,725 in 1900.

The Stock Market

At the outset of the past week the general stock market received something in the nature of a mild shock from the speech made by a very prominent banker before the Chamber of Commerce, relative to the monetary laws of this country, which the banker in question maintained made possible the great stringency and attendant exorbitant high rates in the money market witnessed during the closing days of 1905. For a brief spell there were evidences of a desire on the part of stockholders to liquidate, and momentarily prices fell away quite sharply. However, the remarkable power of absorption which the market has displayed for so long a time, and to which allusion has frequently been made in this column, again demonstrated itself, and the securities thrown over as a result of the incident above referred to found ready takers. In consequence of this and a subsequent clearer understanding of the remarks made by the banker referred to, there was a quick and substantial recovery in values, and throughout the latter portion of the week the tendency of prices was once more immediately upward, although there were occasional intervals of irregularity. These were due to no considerable extent to realization of profits, still a decided strengthening in the foreign exchange market, which rendered possible exports of gold to Paris, and the continued unsettled foreign political situation, played some part in holding the upward movement in check. At the same time local monetary conditions improved very considerably, and the call loan market may be said to have returned to a normal state. Equally important as this, however, was a noticeable infusion of new blood into the stock market, in the nature of a considerable increase in outside buying orders. It may be said that the accession of outsiders was more apparent in the bond market than in that for stocks; nevertheless, the enlarged orders received by commission houses for purchases of stocks were certainly encouraging to the bull cause. Apart from the factors mentioned these purchases were based upon continued unprecedented conditions in the iron and steel, copper metal and other leading industries of the country, the maintenance of railroad earnings on a large and expanding scale, and the exceptional character of the winter thus far, which permitted of unusual activity in many lines of business. In response to the general buying noted, many stocks sold at higher prices than ever before, a notable case in point being Union Pacific, which was helped along by talk of a possible increase in the dividend rate. The shares of the grain-carrying roads, those of the trunk lines as well as the anthracite coal properties and some of the Southern systems, all played a more or less conspicuous part in the activity and improvement. The United States Steel stocks occupied a more prominent position in the dealings than heretofore, and the common, on talk of a resumption of dividends, sold at the highest figure in years, while the preferred made a new high record. The stocks of the Southern iron and steel properties were again strengthened by revived talk of a merger, and the copper stocks again responded to the strength of the metal, though the latter subsequently reacted some on profit-taking sales.

The local traction stocks attracted comparatively little attention during the week, and generally moved in sympathy with the balance of the market. News in reference to these properties was unusually scarce, and even rumors were conspicuously absent. In short, speculation in this class of securities appeared to be resting, following the recent announcement of the deal between the Interborough and Metropolitan interests.

Philadelphia

Dealings in the local traction issues have been considerably larger during the past week, and in most instances they have been accompanied by substantial advances in values. Philadelphia Rapid Transit was again the leader of the group, both in point of activity and strength, the price rising 2¼ points to 33 on reports of heavy earnings and on persistent buying, said to be for New York account. Upwards of 23,000 shares were traded in. Philadelphia Company common was under pressure during the greater part of the week. In the early dealings the price sagged off to 31, but later there was an advance to 32½. In the final dealings there was a reaction of a point. About 5500 shares were traded in. The preferred stock advanced a full point to 51, on extensively light purchases. A special meeting of the United Railway Investment Company of San Francisco has been called, at which the stockholders will be asked to authorize an increase in the capital stock from $10,000,000 to $25,000,000. It is understood that part of the proceeds of this stock issue will be used to acquire the Philadelphia Company. Philadelphia Traction rose ½ to 101, on the exchange of less than 500 shares of stock, and Fairmount Park Transportation rose a full point to 17½, on a single transaction involving 100 shares. American Railways was steady at 52, and Union Traction held firm at 62½, with sales of nearly 1000 shares at that figure. Other transactions included West Philadelphia Passenger at 250, Railway General at 7½ and 7, United Companies of New Jersey at 270, Consolidated Traction of New Jersey at 80, and United Railways of Indiana at 91.

Baltimore

There was a decided improvement in tractions at Baltimore. The market was broader, and prices generally displayed a decided upward tendency. United Railway issues constituted the leading feature, prices for both stock and bonds advancing sharply on heavy transactions. The 4 per cent bonds sold to the extent of $90,000, at from 93 to 94 and back to 93⅝, while the free incomes rose from 66 to 67½, on the exchange of about $175,000 bonds. The pooled incomes brought prices ranging from 64½ to 66½ for $84,000 bonds. Of the free stock 150 shares brought 15, while 500 shares of deposited stock sold for 15¾ and 16. Norfolk Railway & Light 5s sold at 96¼ and 96½ in the early dealings, and later $50,000 sold at 98. Virginia Railway & Development 5s were active, $31,000 changing hands at from 99 to 99¾. Other sales included North Baltimore 5s at 119, United Traction of Pittsburg 5s at 112¾, Lexington Street Railway 5s at 104½, Macon Street Railway 5s at 98½, Washington City & Suburban 5s at 106, Charleston Electric 5s at 97½, and 100 shares Norfolk Railway & Light stock at 13¾.

Other Traction Securities

Trading in the Chicago market was quiet, but prices held firm. Chicago City Railway sold at 200 for a small lot. Nearly 1000 shares of Chicago Union Traction brought 11⅞ and 12⅜, and an odd lot of North Chicago sold at 82. West Chicago sold at 54½. South Side Elevated lost a point to 96. Northwestern Elevated common was strong, with transactions at 25½ and 26½, while the preferred stock brought 65 and 66. Metropolitan common sold at 28 and 27½, and the preferred changed hands at 70 and 70¼. Chicago & Oak Park common brought 7⅜ and 7¾. The Boston market was extremely quiet. Odd lots of Boston Elevated were marketed at prices ranging from 156 to 157. Massachusetts Electric issues were active, about 1000 shares of the common selling at 17 and 18, while about 1200 shares of the preferred sold at from 60 to 64 and back to 62½. Boston & Suburban preferred sold at 63. West End common brought 101 and 99½, while the preferred brought 112 and 113. In the New York curb market Interborough Rapid Transit developed considerable activity, and although the dealings were accompanied by an erratic price movement, it ended the week with a substantial net gain. From 233¾ the price ran off to 230, and later advanced to 236. At the close there was a reaction to 234. Upwards of 10,000 shares were traded in. The securities to be issued by the new Consolidated Company were active, upwards of 4000 shares of the new common selling at from 58¾ to 60, while nearly $1,000,000 of the new 4½ per cent bonds changed hands at from 96 to 95½. New Orleans Railway & Light 5s sold at 91¾ for $5,000.

Cincinnati, Newport & Covington common continues to be the active issue in Cincinnati. About 1000 shares changed hands with a fractional decline from 52½ to 51⅞; the preferred declined from 99 to 98¼. The 5 per cent bonds showed a fractional advance to 110½. Cincinnati, Dayton & Toledo advanced a point to 26¾, and $15,000 worth of the bonds sold at an advance from 97¼ to 97½.

Little activity in Cleveland. Northern Ohio Traction & Light moved up from 32¾ to 33½ on reports of heavy sales to Canadian parties, but the early part of this week it went off a point. Western Ohio made a gain from 20¾ to 21½ with the opening of its new extension, and its bonds were slightly stronger, several blocks selling at 87¼. Lake Shore Electric common has been showing a fraction decline from 17 to 16½. There was some trading in Cleveland & Southwestern common at 15, several points below previous sales. Cleveland Electric was weaker at 84. A small lot of Aurora, Elgin & Chicago common sold at 36, an advance. Toledo Railways & Light sold at 32¼, and Elgin, Aurora & Southern at 52. Several small blocks of Washington, Baltimore & Annapolis underwriting sold at 108, a fractional decline, due to a recent call for the second payment on the subscription. Eastern bond buyers have closed a deal for $225,000 of Western Ohio 5s.

Security Quotations

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

	Jan. 3	Jan. 10
American Railways	52½	52
Boston Elevated	156	157
Brooklyn Rapid Transit	86½	88⅜
Chicago City	200	197
Chicago Union Traction (common)	11½	10⅞
Chicago Union Traction (preferred)	—	—
Cleveland Electric	80	83
Consolidated Traction of New Jersey	81	81
Consolidated Traction of New Jersey 5s	107	107½
Detroit United	94½	94⅝
Interborough Rapid Transit	231½	234
International Traction (common)	—	36
International Traction (preferred) 4s	—	75½
Manhattan Railway	161¼	160
Massachusetts Electric Cos. (common)	16½	18
Massachusetts Electric Cos. (preferred)	59	62½
Metropolitan Elevated, Chicago (common)	28	27
Metropolitan Elevated, Chicago (preferred)	70	70
Metropolitan Street	122½	124⅜
Metropolitan Securities	72¼	73½
New Orleans Railways (common)	39½	38½
New Orleans Railways (preferred)	84¾	84
New Orleans Railways, 4½s	91	91
North American	98	101⅜
North Jersey Street Railway	25	25
Philadelphia Company (common)	51½	51⅝
Philadelphia Rapid Transit	31½	32
Philadelphia Traction	100½	101

	Jan. 3	Jan. 10
Public Service Corporation 5 per cent notes	95½	95½
Public Service Corporation certificates	68	69
South Side Elevated (Chicago)	97	96
Third Avenue	135	138
Twin City, Minneapolis (common)	117¼	120
Union Traction (Philadelphia)	62	62½
West End (common)	98	99
West End (preferred)	113½	113½

Iron and Steel

According to the "Iron Age," the principal event of the week in the iron and steel trades has been the advance in prices on the greater part of all the lighter finished products. There are further indications of a revival of buying of pig iron, although the movement is not yet quite general. In the heavy trade there has been no very pronounced movement, and no very large contracts have been closed in structural material.

EARNINGS WORCESTER RAILWAY & INVESTMENT COMPANY

The trustees of the Worcester Railways & Investment Company have issued their annual report for the fiscal year ended Dec. 30, 1905. This company owns the control of the Worcester Consolidated Street Railway Company. The income account for the year is as follows:

	1905	1904
Gross earnings	$237,282	$315,138
Previous surplus	149,761	162,732
Total	$387,043	$477,870
Expenses	4,411	4,567
Balance	$382,632	$473,303
Dividends	359,490	323,541
Surplus	$23,142	$149,762

CLEVELAND FRANCHISE SITUATION—TEMPORARY INJUNCTION AGAINST LOW-FARE COMPANY LIFTED

The Common Pleas Court has refused to grant a permanent injunction restraining the Forest City Railway Company, the so-called 3-cent fare company, from occupying Denison Avenue, and has lifted the temporary injunction, so that the company can go ahead with its work, providing the case is not carried higher. The City Council adopted a resolution requesting the Cleveland Electric Railway Company to permit the judgment to stand as final, so as not to further delay the building of the low-fare line. The appeal was on the ground that further continuation of the struggle would forfeit the good will of the public. The company has not yet replied to the request.

The village of Newburg, adjoining Cleveland, recently granted the company a twenty-five-year franchise for an extension of the Woodland Avenue line. Negotiations were under way at the time for the admission of the village to the city, and the City Council intimated that if the franchise was allowed to stand, the village would be refused admission. The village Mayor thereupon vetoed the franchise ordinance, but a new Council, now in office, is endeavoring to put it through again.

The Chamber of Commerce committee is now investigating the franchise situation with a view to a settlement. In accordance with its announced plan, the investigations are carried on behind closed doors. In giving testimony last week Mayor Johnson carried his point about making his portion of the testimony public property, by taking with him a stenographer, who read his notes to the reporters after the meeting. Mayor Johnson reiterated a plan which he has talked of for a long time for the formation of a company or commission to acquire the property by an option for the future, and paying for the properties with securities which would be a lien on the property. He paid a high tribute to the business integrity of President Horace Andrews, but he expressed the opinion that the city and the company could not get together on a reduced rate of fare.

Mayor Johnson is endeavoring to have the present Legislature pass a measure permitting municipalities to own and operate street railway systems. His hope is to sell city bonds for acquiring the existing property or building parallel lines.

PROPOSED AMENDMENTS OF THE CHICAGO FRANCHISE ORDINANCES

John M. Harlan, recently appointed by Judge Grosscup to represent the interests of the people of Chicago in the traction issue, on Jan. 1 made an extended report to Judge Grosscup, in which the following points were brought out:

"There should be some effective provision to prevent the lien of existing bonds upon the companies' unexpired franchises, licenses and rights, whatever they may be, from being utilized through foreclosure as a means of nullifying the express waiver or release of those rights.

"The Consolidated Traction Company should be made a party to the proposed settlement. Its franchises vary in unexpired length from about six years to nearly fifty years. If settlement is not had now with that company, the city in a very few years will be again confronted by a traction problem.

"Each of the settlement ordinances should contain a provision that it shall not become operative until and unless the others are accepted."

As a result of this report the following amendments to the franchise extension ordinance have been proposed and are being considered:

"That the Union Traction Company shall, withing three years, either retire or provide for the payment of $11,000,000 of its outstanding bonds, and, failing to do that, forfeit its franchise.

"That the consolidated companies shall agree to surrender all their present franchises and accept in lieu a new one from the city.

"That the ordinances, both for the Union Traction and the Chicago Companies, must all be accepted before any one of them becomes operative."

The committee on local transportation met in special session Monday to discuss the traction franchise ordinance and the proposed amendments to it. The session lasted six hours, after which it adjourned until Thursday, to await an answer from the traction companies as to whether or not the proposed amendments can be accepted. At the close of the day there seemed to be a general idea that there was little chance that an ordinance suitable to the railway companies would be agreed on in time for presentation to the people at the spring election.

In the discussion of the ordinance, the views of several gentlemen were given. Walter L. Fisher, secretary of the Municipal Voters' League, was the principal speaker. He endorsed the Harlan amendments and recommended that the clause by which the city protects the companies in their franchise taxes be stricken out. He objected to the clause providing that only granite blocks be used in paving the tracks, and also suggested a prohibition against the issuing of passes.

Secretary Hooker, of the City Club, did not think the committee was warranted in framing franchise ordinances to the exclusion of an effort to find some means of carrying out the express will of the people.

Mr. Harlan explained that he was employed by the Federal Court to see that the ordinances were in such shape that the court could assure the people that they had been safeguarded in their rights. Regarding his amendment providing for the retirement of bonds, he said he had found it extremely doubtful that the bondholders could be bound by an order from the court. He had therefore suggested the retirement within three years of all bonds over the $20,000,000 of bonds which live for more than twenty years.

"What I meant by this," explained Mr. Harlan, "was the $5,000,000 of bonds which expire in the twenty years' period, not the $5,500,000 of floating debt and receiver's certificates, which can look out for themselves. As $4,250,000 of this $5,000,000 of bonds mature inside of three years, they will have to be taken care of anyhow, leaving only a negligible remainder.

"In the matter of the Consolidated Company, what I have to say is in opposition to the views of Judge Grosscup. He holds that to give that company new franchises would give value to the $6,500,000 of bonds which can be styled Chicago's involuntary contribution to the late Mr. Yerkes.

"As I look at it, however, the bonds are there and must be taken into account, and it does not matter if some value is given them if by so doing the city of Chicago is more fully protected. Under these ordinances the Consolidated Company has a right to the through loops, and if its franchises expire it can use the tracks of the Union Traction Company by virtue of its contract with that corporation."

Regarding his provision that unless all the ordinances were accepted by the guarantee companies, none of them become operative, he said:

"Suppose the matter was left as it is now, and after the ordinances were passed the Chicago City Railway were to accept and the Union Traction did not. Good service installed on the south side and the rest of the city left to stew. What would the west and north side people think of that?

"I do not believe, if the ordinances were absolutely perfect in every other particular, the people would be satisfied if this amendment were left out. Let it be said to the voters of the north and west sides that the south side is to have good service and they are to be left out, and you won't have a corporal's guard back of your ordinances in those two sections. If you leave the common acceptance clause out, you are wasting your time on those ordinances. Look out for the election returns from the north and west sides.

"The only objection I have heard to this amendment has been that the South Side road is the stronger financially, and if it had to depend on the other roads' acceptances for its ordinance some holder of Union Traction securities might make unreasonable demands. If it did the Chicago City would not have to yield."

AMERICAN LIGHT & TRACTION MAKES PURCHASES

The reason is divulged for the increase in the stock of the American Light & Traction Company, of which mention was made in the last issue of the Street Railway Journal. The company is to take over the Lacomb Electric Company, of Denver, Col., and the Muskegon Traction & Lighting Company, of Muskegon, Mich., and the proceeds derived from the sale of the recently issued 7139 shares of stock are to be used to meet the cost of the new properties.

PROPOSED LEGISLATION IN MASSACHUSETTS

With the opening of the Legislature for 1906 in Massachusetts, street railway and railroad matters are coming promptly to the front. Governor Guild's reference to street and electric railways in his inaugural address is regarded as an attempt to strike the keynote for railway legislation that is regarded as inevitable at this session. In a way, his recommendation for general laws rather than special legislation does little more than urge a continuance of what the Legislature has already declared for in previous years, and what it specifically aimed at in the session of last year, when it broke off abruptly in a heated consideration of special charter rights to refer the whole question of changing the laws affecting street railways and interurban lines in the Commonwealth to a special committee.

The controversy at that time was over a new interurban line between Boston and Providence, in which Stone & Webster interests, which were back of one project, were vigorously opposed by the combined forces of William A. Gaston, of the Boston Elevated Railway, and James F. Shaw, of the Boston & Worcester Street Railway, in seeking a special charter. The report of the special committee on street railways and railroad laws is expected to recommend a general law under which interurban lines of this kind can be built; and the Railroad Commission, in making their annual report to the Legislature, may make some reference to the general subject which may aid in formulating any amendments or additions that are deemed wise by the General Court. These reports are now being prepared, but have not yet been considered in detail by the legislators. Both are known to favor the thing which Governor Guild has recommended, that is, general law for all kinds of railway development rather than special charters; for the Commonwealth is now definitely committed to this kind of legislation, and special charters can get through this year only by the hardest kind of a contest.

It is evident that there will be no lack of attempts to get some of them through, however. One bill has already been introduced which not only calls for a special charter but which in a way is likely to bring up the whole controversy of last year regarding an interurban line from Boston to Providence. It is a bill providing for the incorporation of the Massachusetts Street Railway Company, naming $5,000,000 as the desired capitalization, and seeking special rights to purchase land, or to lease it, or take it by right of eminent domain, for construction of a line from Boston to Fall River, New Bedford and Providence, the same to be used for high-speed street railway service. The petitioners named in the document are: Thomas J. Mulvahill, Daniel J. Toomey, John J. McNamara, James J. Connelly, Bernard J. McCarron, William S. Haverty and James T. Cox. These names have not so far been identified with street railway construction in a prominent way, and probably do not represent the real instigators of the bill.

The statistics and computations embodied in the annual report of the Railroad Commission will not be ready until some time later in the year.

FAILURE OF NEWSPAPER ATTACK

One of the local papers in Minneapolis, for reasons known only to itself, began some time ago an attack upon the Twin City Rapid Transit Company, for the use of gates on its cars. The thing was featured day after day, and was worked as "copy" for all it was worth. Finally, an expression of opinion was asked of the public. Out of a population of 261,974 only 1100 votes were received, fully 30 per cent of which were in favor of retaining the gates. The company did not reply to the attack until the vote had been taken, and the paper which instituted the agitation had acknowledged failure. Then it published, through another medium, a statement refuting the charges made against it. In view of the audacity of this attack, which was wholly without justification and contained charges in themselves preposterous, the reply of the company, over Vice-President Goodrich's signature, is appended in full. A feature of the letter of especial interest is the statement regarding the reduction in the number of accidents which followed the introduction of the gates. The letter follows:

To the Patrons of the Street Railway Company:

We have seen of late some criticism on the use of gates on the cars of the street railway company. In this connection statements have been made to the effect that the gates were put on the cars—

First—Solely for our own benefit.

Second—Contrary to the wishes of our patrons.

Third—In a spirit of reckless defiance of public sentiment, and,

Fourth—That our duty to the public did not require us to do so.

The first statement is true in part.

The second statement could not be true, as our patrons did not have, and therefore could not express, any preferences about gates until after they had been installed.

The third statement is absolutely false. Our respect for "public sentiment" when it is right is supreme. When it is wrong or based upon erroneous assumption, we frankly admit we are afraid of it. In either contingency, however, our respect for it is entirely too healthy to meet it in a "spirit of reckless defiance."

That the fourth statement is also untrue will appear from the following quotation from a Supreme Court decision rendered in one of our cases:

"Street railway companies, as carriers of passengers for hire, are bound to exercise the highest degree of care and diligence consistent with the nature of their undertaking, and are responsible for the slightest neglect. This rule extends to the management of the cars and track, and to all the arrangements necessary for the safety of passengers as respects accidents from collision or otherwise."

If gates on street railway cars are an "arrangement" which will minimize accidents, and are not inconsistent with street railway business, then it not only was our duty to the public to equip our cars with gates, but the above ruling of the Supreme court was tantamount to a mandatory order instructing our company to do so.

It will not be contended that gates to prevent passengers from getting on and off moving cars are inconsistent with the work of carrying passengers.

As to whether gates minimize accidents, the following figures speak for themselves:

In the year 1894, the year before gates were installed, we had 1655 accidents caused by people getting on and off cars.

In 1904, ten years later, notwithstanding the fact that we handled more than twice as many passengers, accidents due to getting on and off our cars were only 259. These figures include both cities.

If the 1894 percentage of accidents to passengers handled had prevailed in 1904 our accidents due to getting on and off cars would have been over 3500 instead of 259.

If human life and suffering are entitled to any consideration, then "our duty to the public" would seem to be apparent. I can and do understand fully that at times the gates may prove an annoyance, but, taking all the conditions into consideration, I do not believe, or at least I do not wish to believe, that anyone familiar with all the facts in the case would wish them discarded.

No consideration of the case will be complete which does not take into consideration the fact that fully 65 per cent of our passengers are either women, children or elderly persons.

C. G. GOODRICH, Vice-President.

UNITED RAILWAYS TO ADD $15,000,000 TO STOCK

There will be a meeting of the stockholders of the United Railways Investment Company, of San Francisco, on Jan. 31, in Jersey City, for the purpose of considering a plan to increase the common stock of the corporation to $25,000,000. It is now $10,000,000. It is the purpose to use the proceeds from the sale of the new stock for the payment of $900,000 back dividends on the preferred stock, the dividend rate upon which was recently raised from 4 to 5 per cent, or the full rate to which it is entitled; also, to assist in taking over a majority interest in the Philadelphia Company, of Pittsburg. This deal was practically consummated some weeks ago, and involved about $55,000,000.

The United Railways Investment Company controls the United Railroads of San Francisco, and has a capital stock of $25,000,000, of which $15,000,000 is preferred. It has acquired and keeps in its treasury 200,000 shares of 4 per cent cumulative preferred and 199,991 shares of common stock of the United Railroads, that being the total authorized issue, with the exception of nine shares held by the directors.

According to the best advices the offer of the United Railways for the Philadelphia Company was $37.50 a share in a new collateral trust bond, with its own guarantee attached, and $20 a share of its own stock for each share of the common stock of the Philadelphia Company. The United Railways is now earning 10 per cent, and because of its prosperity advanced its dividend rate. Two dividends of 2 per cent each were declared in 1905 before the rate was raised to 5 per cent.

The Philadelphia Company was incorporated by special act of the Pennsylvania Legislature in 1871 as the Empire Contract Company. It was organized under its present title in 1884, and has among its holdings 465 miles of street railway in Allegheny County, Pa., controls the bulk of the natural gas and electric light business of that county, as well as of many important manufacturing towns along the Monongahela, Ohio and Allegheny Rivers, and owns and controls 632 gas wells and 3,215,502 acres of oil and gas territory. The allied corporations of the company, covering the cities of Pittsburg and Allegheny, and Allegheny County, are the Equitable Gas Company, the Consolidated Gas Company of Pittsburg, the Allegheny County Light Company, and the Pittsburg Railways Company. The gross earnings of the constituent and subsidiary companies of the Philadelphia Company are now at the rate of over $15,000,000 a year, and it is estimated by a competent authority that the sum available for the Philadelphia Company from earnings for the year ended Dec. 31 last is not far from $2,500,000. The capitalization of the company is $34,697,845, of which $28,953,029 is common and $5,744,812 preferred stock. The corporation also has a bonded indebtedness of $20,000,000.

PRESIDENT HENRY OF THE INDIANAPOLIS & CINCINNATI COMPANY ENTERTAINS

A party of electric railway officials and their wives were entertained at dinner, Monday evening, Jan. 1, at the Columbia Club, Indianapolis, by Charles L. Henry, president of the Indianapolis & Cincinnati Traction Company. The dinner was preceded by an inspection of the company's property that required several hours to complete. Mr. Henry acted as toastmaster. Hugh J. McGowan, president of the Indianapolis Traction & Terminal Company, sent his regrets. His brother, Joseph McGowan, read the following for Hugh McGowan:

Seven years ago to-night I left Kansas City for Indianapolis, arriving here the following afternoon, since which time I have been a resident of this fair city. Soon after my arrival it was my good fortune to meet the distinguished gentleman who is to act as toastmaster to-night, and to learn of the great projects which he had in contemplation in the interurban field, and also to become acquainted with those gentlemen whose names will go down in history as the first promoters in the work of linking together the thriving cities and villages of Central Indiana.

My first desire was to improve local conditions and bring to the highest standard of efficiency the street railway system of the city of Indianapolis, and next to welcome and assist in every way the projected interurhan lines and make it possible for them to reach the very center of our city. * * * From the time I first gave the subject attention, I had implicit faith in the great future of interurban lines in Indiana, and used my best endeavor to promote their welfare.

One by one I have witnessed the completion of seven different interurban lines, made contract for their entrance to the city, and hailed their advent as marking a new era in transportation. Another line is now being built to Brazil, and two more companies have plans under serious consideration. The small towns, as well as the cities, are being benefited, and local travel is created and stimulated.

I cannot let this opportunity pass without complimenting the president of the Indianapolis & Cincinnati Traction Company upon the splendid result of his single-phase system on the Rushville line, which is being watched by many of the greatest electrical engineers of the country with peculiar interest.

That there should be one central station, at which all interurban cars should arrive and from which they should depart, early occurred to me, and this idea took concrete form in the erection of the present Traction Terminal Building, which is conceded to be the first and finest of its kind in the country.

On the first day of the new year it is customary not only to review the past, but also to contemplate the future. We have already seen what has been done during the last seven years, and yet the work of the interurban roads has but fairly begun. As our lofty monument stands in the center of our city, piercing the sky, an object of wonder and admiration to all, so will Indianapolis tower above every city in the United States as the greatest interurban center in the world.

Other speakers were John Shea, of Seymour; Col. Winfield T. Durbin, Ferdinand Winter, Theodore F. Rose, of Muncie, and W. A. Huff, the latter speaking for William L. Taylor. All the speakers paid high compliments to Mr. Henry on the perfection of the road in such short time.

RIGHT OF EMINENT DOMAIN EXISTS IN ILLINOIS

Considerable interest has been attracted to the statement made recently in the daily press and recorded in the Street Railway Journal, to the effect that, by a decision handed down by Judge Thompson, in the Superior Court, sitting in Chicago, in a suit brought by the Chicago & Southern Traction Company, the right of electric railway companies to condemn land was denied. The real question before the court, and the only one upon which it passed, was the motion to dismiss the petition because it failed to allege that the right of way sought to be condemned under the Eminent Domain Act was necessary for the right of way of the street railway company. Subsequently, Judge Thompson said: "I did not decide that the street car company did not have the right of eminent domain to condemn private property. I did not decide that question because that was not the question in the case. The only question I decided at all in this case was that the petition, failing to allege necessity for the property as a right of way, it was defective, and that the motion to dismiss should be sustained. That is the only point I decided, and I believe that is a proper statement in the case."

ENTERTAINMENT FOR BROOKLYN EMPLOYEES—CHANGES IN OPERATING DEPARTMENT

Announcement has been made of the date of the entertainment to be given the employees of the Brooklyn Rapid Transit Company by the Brooklyn Rapid Transit Employees' Association, at the main club house of the association at East New York. The entertainment is to run for a week, beginning Jan. 15, with two performances daily, one at 2:30 and the other at 8:15. The bill will be vaudeville, and will include in its nine numbers the best talent showing in New York at the time. This is the second annual entertainment of the kind to be given by the association. The arrangements this year are essentially the same as governed last year's show. One particular in which they differ, however, is in the plan for a matinee every afternoon, instead of a solitary matinee on Saturday for the children, as was the case last year. Upwards of 1000 persons attended each evening last year, but this record, it is thought, will be exceeded this year, even considering the extra performances in the afternoon. The foresight of those who planned the club house makes entertainments of this kind possible. There are provided a permanent stage and stage setting and 500 numbered orchestra chairs, in addition to which there are available more than 500 portable benches with backs, which, when occasion requires, are arranged on the gymnasium floor, which opens into the regular concert and lecture room. Music will be furnished by the association band, composed of employees of the company. The entertainment is free to all employees and their families. Even free transportation is arranged for by the company, two coupons being attached to each ticket, good for passage to and from the clubhouse.

In establishing, on Jan. 1, two positions in the operating department of the Brooklyn Rapid Transit Company, to be known as district superintendents, the four positions of division superintendents have been abolished. Heretofore, two or more depots of the company have been in charge of what was known as a division superintendent, the eleven depots being under the supervision of five superintendents. In order to centralize the operating department, a rearrangement of this service has been made by placing all of the eleven depots under the jurisdiction of two men. William Siebert, who has heretofore had charge of the Ridgewood, Halsey Street, East New York, Bergen and the Bridge Operating Company, in the future will hold the position of superintendent of the Eastern District, and be in immediate charge of Cross-town, Maspeth, East New York, Bergen Street, Halsey Street and Ridgewood depots and Bridge Operating Company, while E. F. Davis, who previously was in charge of the Fifty-Eighth Street, Ninth Avenue and Twenty-Third Street depots, will have the Flatbush and Canarsie depots added to his jurisdiction, and he will hold the title of superintendent of the Southern District, including the operation of cars through lower Fulton Street, into which turn most of the lines crossing the Brooklyn Bridge. Both under the new arrangement will be amply provided with assistants in immediate charge of each depot. This rearrangement abolishes the positions of division superintendents, formerly held by Frank Bush and George Stone, as well as that formerly held by Frank Moshofsky, who was chief clerk. Mr. Bush, it is announced, has resigned from the company. He entered the service as a conductor, and was with the company many years.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED DEC. 26, 1905.

808,062. Car Truck for Motor Propulsion and the Like; Walter S. Adams, Philadelphia, Pa. App. filed Nov. 29, 1902. Consists of a side frame, a bolster, a quarter-elliptic spring rigidly attached to the bolster and spring-supported pivoted means for connecting the bolster and side frame.

808,109. Trolley Pole; James F. Osburn and William T. Coad, Pasadena, Cal. App. filed June 21, 1905. To overcome the liability of the wheel leaving the wire the harp is made very wide and is provided on each side of the trolley wheel with guide rollers tapering toward the wheel.

808,139. Electric Trolley Head; John T. Cherry and Edward H. Clive, Plymouth, England. App. filed March 28, 1905. Pivoted jaws adapted to be swung upward to guide the wheel to the wire.

808,163. Trolley Harp for Electric Railways; John Miller, Jr., Amesbury, Mass. App. filed April 10, 1905. Provides a harp having its opposite sides spread and specially shaped to embrace and overlap the elongated conical hubs and bearing of the contained wheel and receive a fixed shaft, binding all the parts together, and so arranged as to receive and transmit current to the best advantage with minimum wear.

808,182. Electric Signal System for Electric Cars; Edwin J. Adams, Waco, Tex. App. filed March 6, 1905. Supplemental trolleys for operating various signal circuits.

808,198. Valve Governor for Trolley-Pole Controllers; Martin O. Dolson, Los Angeles, Cal. App. filed Feb. 20, 1905. Provides a novel device for actuating when the trolley pole makes a sudden movement upwardly to throw a pneumatic valve and cause the trolley pole to be automatically lowered.

808,213. Contact Shoe for Third-Rail Electric Railways; William B. Potter, Schenectady, N. Y. App. filed July 25, 1903. A combined collector-shoe and ice-scraper for a third rail comprising a plurality of runners, rectangular in cross section and arranged at an angle to each other.

808,222. Third-Rail Insulator; Samuel B. Stewart, Jr., Schenectady, N. Y. App. filed July 23, 1903. Comprises a cap composed of two integral parts, each of which consists of a rail-retaining ear and a plug portion, and an insulating support having a socket for receiving the plug portions.

808,231. Automatic Switch; Joseph M. Comer, Seattle, Wash. App. filed April 27, 1905. The switch is thrown by means of magnets in the roadbed. When the magnet is energized a ratchet is stepped around which rotates a vertical shaft suitably connected to the switch point.

808,238. Emergency Brake Valve; George H. Hill, Schenectady, N. Y. App. filed June 24, 1904. Two emergency valves connected in series and arranged normally to establish connections for applying the brakes and independent controlling means for said valves.

808,268. Controlling System; Thorsten Von Zweigbergk, Lancaster, England. App. filed April 25, 1904. A control system having a number of features, among others an automatic controller and a master controller for the automatic controller having a ground connection for the motor at zero or off position.

808,271. Emergency Control System; Frank E. Case, Schenectady, N. Y. App. filed June 24, 1904. Relates to a system in which the power is cut off and brakes applied in case of accident to the motorman, and consists of two operating levers, an emergency device and connections therebetween whereby the emergency device is rendered operative only by a simultaneous release of both levers.

808,298. Device for Operating Street Railway Switches; Albert J. Molina, Havana, Cuba. App. filed Sept. 9, 1905. Details of construction.

808,314. Car Brake; Charles H. Shaner, McKeesport, Pa. App. filed March 31, 1905. A pair of oppositely disposed pivotally mounted levers between the two wheels of a car truck, and carrying rail-contact shoes adapted to be depressed by fluid-pressure means.

808,545. Electric Railway System; William G. Keeler, Philadelphia, Pa. App. filed June 16, 1905. An endless cable mounted underneath the car engages current-supplying contacts spaced in the roadbed.

808,589. Trolley Finder; James Wilhelm, Philadelphia, Pa. App. filed June 20, 1905. Guard arms pivoted in the trolley harp for replacing the wheel on the wire.

PERSONAL MENTION

DR. H. B. ROCKWELL has resigned as general superintendent of the Mobile Light & Railroad Company, of Mobile, Ala.

MR. R. W. HARRIS, for more than a year superintendent of the Michigan Traction Company, of Kalamazoo, Mich., has resigned from the company.

MR. W. W. STREET has resigned as traffic manager of the Lansing & Suburban Traction Company, of Lansing, Mich., to become connected with the Jackson & Detroit Electric road in a similar capacity.

MR. HENRY T. WAKLEY, who for several years has been employed by the Hudson Valley Railway as motorman, express messenger and despatcher, has been promoted to the position of assistant superintendent of the Saratoga division, with headquarters at Saratoga.

MR. L. W. PRIOR, of Dennison, Prior & Company, of Cleveland, died suddenly in the Hotel Hollenden, Cleveland, on Tuesday, Jan. 9. Mr. Prior is well known in the East and in the Middle West through the connection of his firm with the financing of important street railway projects.

MR. JOSEPH A. McGOWAN, secretary to Mr. Hugh J. McGowan, president of the Indianapolis Traction & Terminal Company, has been appointed auditor of the company, and Mr. Le Roy E. Snyder has been appointed to succeed Mr. Joseph A. McGowan as secretary to the president.

MR. C. C. REYNOLDS, general superintendent of the merged interurban lines in Indiana, has moved his headquarters from Lebanon to the Traction Building, Indianapolis, and will share offices with Mr. D. G. Edwards, vice-president of the company, who will spend a portion of his time in Indianapolis.

MR. J. G. BAUKAT, who resigned his position as master mechanic of the Schenectady Railway Company about two months ago, has been appointed assistant to Mr. C. H. Quereau, whose appointment as superintendent of electrical equipment of the New York Central Railroad is announced in this column.

MR. A. F. ELKINS has been appointed auditor of the Columbus, Delaware & Marion Railway, with headquarters at Delaware, Ohio, succeeding Mr. Frank W. Rood, who will enter the employ of an Eastern traction company. Mr. Elkins was formerly cashier for the Marion Street Railway & Light Company, of Marion, Ohio.

MR. R. D. BEATTY, of Cleveland, has been appointed general manager of the Eastern Ohio Traction Company. Mr. James Doyle has been promoted general superintendent. Mr. Joseph Emerick has been appointed superintendent of the Eastern division, and Mr. Lawrence O'Toole, superintendent of the Chagrin Falls division.

MR. ALEXANDER E. ORR, chairman of the Board of Rapid Transit Commissioners of New York, which arranged for the building of the subway, has been elected to the presidency of the New York Life Insurance Company. Mr. Orr is a native of Ireland, but has been connected with industrial and civic development in New York since 1851.

MR. WILLIAM S. EARLE, for the past four years connected with the office of the City Engineer, of Worcester, Mass., has resigned, to accept a position under Mr. Frederick A. Huntress, general manager of the Rio Janeiro Street Railway & Power Company, who was formerly general manager of the Worcester Consolidated Street Railway.

MR. WILLIAM F. WHITE, for many years vice-president of the North American Company, has resigned that office, and his resignation has been accepted. Mr. White will go to Europe in a few weeks, and on his return will devote himself to his private interests, prominent among which are a number of rich silver mines near Cobalt, Canada.

MR. THOMAS M. KEELEY, formerly engineer of the Lansing & Suburban Traction Company, has been appointed superintendent of the Kalamazoo city lines; Mr. J. J. Martindale, formerly electrical engineer of the same company, has been appointed superintendent of the Battle Creek city lines, and Mr. E. S. Loomis, superintendent of the Jackson & Battle Creek Traction Company, has had the interurban line between Battle Creek and Kalamazoo added to his division.

MR. HARRY M. BEARDSLEY, secretary and treasurer of the Elmira Water, Light & Railroad Company, of Elmira, N. Y., has been appointed receiver of the Elmira & Seneca Lake Railroad Company in place of Mr. D. A. Hegarty, of New York City. The line will be operated by the Elmira Traction Company, and Mr. Beardsley, who has had a large share in the negotiations which have been on for some time, is splendidly qualified by virtue of his intimate acquaintance with the affairs of the line to administer the receivership.

MR. PATRICK CALHOUN, who retained a considerable interest in the United Railroads of San Francisco, when Ladenburg, Thallman & Company took over the interest of Brown Bros. in the company, has been elected president of the company to succeed Mr. Arthur Holland, who retired on Jan. 1. Mr. Calhoun will continue to reside in New York City. It is reported that Mr. Charles H. Holbrook will be selected as managing director of the company. General Manager George F. Chapman will be made a vice-president of the company with enlarged powers.

MR. C. H. QUEREAU, formerly superintendent of shops of the New York Central & Hudson River Railroad Company, has been appointed superintendent of electrical equipment of that company and will have charge of the electric rolling stock. He will report to Mr. E. B. Katté, electrical engineer of the company. Mr. Quereau has been connected with the Vanderbilt lines for the past six or seven years, having been superintendent of shops, and before that superintendent of tests. Previous to his connection with the New York Central, Mr. Quereau was associated with the Denver & Rio Grande Railroad and also with the Chicago, Burlington & Quincy Railroad.

MR. ARTHUR HOLLAND, the retiring president of the United Railroads of San Francisco, was the guest of honor at a dinner given in San Francisco on Dec. 30, at which the directors, officers and heads of departments took occasion to show their regret at his leaving. After speeches by Chief Counsel Terry L. Ford and others, Mr. Holland was presented with a beautifully engraved silver platter. General Manager George F. Chapman, Secretary George B. Willcut, Master Mechanic F. F. Bodler, Chief Clerk J. H. Hanlon, Attorney A. A. Moore and J. M. Duane, member of the banking house of Brown Bros. & Company, of New York, were among those present. Mr. Holland will remain on the Coast for some time.

MR. J. S. HAMLIN, Chicago representative of the St. Louis Car Company, has resigned his position, and will on Feb. 1 become identified with the Ohio Brass Company, of Mansfield, Ohio. Mr. Hamlin will assume the management of a new department, having charge of the sales of the Aikman pressure annunciator, Nicholl-Lintern air sander, hose track bridge and car signal system. Previous to his connection with the St. Louis Car Company, Mr. Hamlin was for the greater part of the eight years preceding identified with the National Electric Company. For more than a year, however, he was master mechanic of the Union Traction Company of Indiana, at Anderson, Ind. In his new work Mr. Hamlin will be located at Mansfield, Ohio.

MR. LEE MASSENGALE, formerly master mechanic of the East St. Louis & Suburban Railway Company, at East St. Louis, Ill., assumed the position of general manager of the Iola Electric Railway Company, of Iola, Kan., Jan. 1. For fifteen years Mr. Massengale was master mechanic of the Lindell Railway Company, of St. Louis. Later, in 1900, he was appointed master mechanic of the St. Louis Transit Company, retaining this position two years. Afterwards he was superintendent of the Rossiter & McGovern Electric Company, being located at St. Louis. He remained with that company until May, 1904, when he became master mechanic of the East St. Louis & Suburban Railway, from which position he has just resigned.

MR. CHARLES C. GLOVER has resigned as vice-president and member of the board of directors of the Capital Traction Company, of Washington, D. C. Mr. Glover, it is said, intended to resign from the company a year ago, but the interests of the company with respect to pending legislation, induced him to defer it, although at a personal sacrifice. For thirty years Mr. Glover has been an influential factor in the affairs of the company and its constituents. He became interested in the company in 1875. By the close of the following ten years the cable system was installed. When electricity became commercially useful a change was made to the underground system, which is the present installation. In both of these changes the systems adopted were not only of the most modern and approved types, but the installations were of the most substantial character. In these particulars it is recognized that the judgment and foresight of Mr. Glover exercised a potent influence. During this interval the affairs of the company have been refinanced on a broad and comprehensive scale, so as to enable it to meet the new conditions that have arisen and to provide the facilities which an expanding business as well as new methods of transportation required.

Street Railway Journal

Vol. XXVII. NEW YORK, SATURDAY, JANUARY 20, 1906. No. 3.

Published Every Saturday by the

McGraw Publishing Company

Main Office:
NEW YORK, Engineering Building, 114 Liberty Street.
Branch Offices:
Chicago: Monadnock Block.
Philadelphia: Real Estate Trust Building.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York"; "Stryjourn, London"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada, Mexico and the Canal Zone.

Street Railway Journal (52 issues)....$3.00 per annum
Single copies ....10 cents
Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August and November) $4.00 per annum
Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy)....$6.50 per annum

To All Countries Other Than Those Mentioned Above:
Street Railway Journal (52 issues), postage prepaid.... $6.00
25 shillings. 25 marks. 31 francs.
Single copies....20 cents
Remittances for foreign subscriptions may be made through our European office.

NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the Street Railway Journal.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires.

Of this issue of the Street Railway Journal 8000 *copies are printed. The total circulation for the year* 1905 *was* 424,350 *copies, an average of* 8160 *copies per week.*

Passes on Interurban Roads

At the last meeting of the Ohio Interurban Railway Association the subject of passes to employees and others was discussed. The subject was brought up by reason of the fact that one of the most important syndicates in the Central West, operating systems in both Ohio and Indiana, has adopted the policy of refusing free transportation to all outside the service of the company, and only granting passes to employees while in the actual performance of their duties. Newspaper men and others heretofore privileged will be included in the ruling. It is stated that the independent lines operating in Indiana will also follow suit.

The sentiment among Ohio roads, however, is that companies can afford to be liberal, at least with employees and their dependents, in the matter of free transportation. It is argued that it would frequently be a hardship upon employees to require fares from their dependents, because, in a great many cases, operating headquarters are located at points where it is impossible for them to secure provisions. It is believed that the refusal of passes would lead to "dead-heading" on cars, a practice which is hard to detect, and which has a tendency to lead to dishonesty in other directions. In the matter of free transportation to newspaper men, it is the opinion that such free transportation is a good investment from an advertising standpoint, and that it is rarely abused. There is a general sentiment, however, among all the roads in this district that free transportation to county and village legislators and to other "friends of the road" should be cut down to a minimum. The recent campaign of pass elimination among the steam roads, and the tendency of the steam roads to reduce rates to meet those of the electric roads, afford excellent reasons why the traction lines should follow suit and close up some of the loopholes through which a large amount of revenue has been allowed to escape in the past.

Guarantees on Power Plants

In large modern plants more attention is being paid to the matter of economy than ever before. Electric railway men have gradually learned that a railway load is not necessarily a hopelessly uneconomical one, and that while the load as a whole is subject to a bad peak, that upon the generators in use is in large plants reasonably steady. One is justified, therefore, in demanding a fair degree of economy in station operation. In planning the station, one of course is able to get guarantees of steam economy in his prime movers, of efficiency in his generators and of duty in his steam generating apparatus. But if one co-ordinates all these with the conditions that hedge them about, he is very apt to find that the partial guarantees do not fit well, and that he can form only an indifferent idea of what the final result at the coal pile is likely to be. In these days of mechanical stokers, the question of firing is not so serious a source of uncertainty as it once was, and while a mechanical stoker may not at all times give the very best results attainable, it should at least give quite uniform results, which can confidently be counted upon month in and month out. With the firing apparatus reduced to a determinable state, it should be possible to put the operation of a plant squarely upon the basis of thermal units in the fuel per kw-hour—to reckon directly from the heat energy at one end of the chain of transformation to the electrical energy at the other. On this basis there is no chance for quibbles—either the plant gives the required result or it does not.

Why should one not be able to make with fully responsible parties a straightforward contract for a new power station calling directly for a specified duty per thermal unit in the fuel provided, or per ton of coal of specified thermal value? Such a contract would give precious little space for dodging the plain issue, and would insure results better than are now attainable, save in rare instances. To begin with, the boilers are generally guaranteed for a duty much greater than is commonly reached. Why not tie the boiler and firing machinery together and demand results, not theories? If superheated steam is to be used, there is always a hole left for successful evasion of boiler duty, and therefore it is well to pass on to the wattmeter, which cannot be dodged. As to the engines and dynamos, their performance is of scientific interest, but the practical man desires to know how much coal he must pay for per kw-hour actually delivered. In many tests of prime movers, too, the power required for the auxiliaries is dextrously dodged, but it may run from 2 per cent of the whole to 15 per cent or more, and there is precious little use in having a prime mover giving the brake-horse-power on 13 lbs. of steam if the actual figure, including auxiliaries, is 15 or 16. In just the same way there is a tendency to dodge the issue of dynamo efficiency. Direct-coupled dynamos are almost always guaranteed without counting loss due to excitation, so that a 95 per cent guarantee really means perhaps 92 per cent to 93 per cent. All these rat holes can be successfully plugged up by going straight back to the coal pile and comparing the inroads made upon it with the results achieved at the switchboard, where it should be seen to that the station wattmeter records the energy used in the station as well as that delivered to the lines. We have no doubt that contractors can be found quite willing thus to guarantee results, and good results. The load for which such a guarantee should be made is, of course, the critical point of the matter. It ought to be a specified particular load, intended to represent the mean load which, with good management, should be attainable. Bring down contracts to definite guarantees of results and the effect will be to improve the efficiency of generating stations all along the line. At present there is plenty of good apparatus available, but it takes a mind reader to figure out from the individual guarantees the probable summation.

Winding Armature Coils in the Shop

Among shop superintendents there seems to be quite a difference of opinion as to whether armature coils should be wound in the shop or purchased already made up from factories which make a business of winding them. We find that some of the larger systems which use a great quantity of coils for one style of machine, purchase all of them, and, again, we know of systems which require but possibly half a dozen sets of coils for one type of motor in a year, that go to the trouble of making their own coils.

In determining upon the advisability of making the coils in the shop, the question of the cost of the coil is sometimes given most prominence. Again, the time required to obtain coils from the factory, as compared with that to wind them in the shop, is a governing factor. Many who have had mysterious armature troubles when factory wound coils were employed, make their own, because they believe the coils will be made more carefully and will have fewer weak spots in the insulation to give future trouble. As often obtained, also, figures on the cost of manufacturing and of buying coils will show up in favor of their being made in the shop. The customary method of calculating the cost by adding the value of the material in the coil to that of the time required to complete a set under trial is at times misleading. There are usually some wastes of material that are not figured in. Again, it should be remembered that the workmen will not apply themselves so assiduously at other times when they know they are not being watched, and that the time the workman actually spends in making the coils is sometimes a comparatively small percentage of the total time spent in making preparation for the work, adjusting the coil formers, getting material together and similar preliminary work. In addition, the interest on the investment, consisting of the stock of materials kept on hand, the winding machines, oven facilities and the percentage of the shop, devoted to these machines should be reckoned, if nearer results are desired. The increase of cost due to all these factors cannot be determined with any degree of accuracy, but under usual conditions it will add materially to the figures obtained by the shorter but less exact method.

Where a shop is in a locality at a great distance from a factory or a supply house from which coils may be purchased, the fact that in an emergency, if made in the shop, a set of coils can be obtained more quickly and with more certainty than if an order is sent out, is often of such importance as to warrant the home work, even at a slightly increased cost over the purchasing price. It might be argued that there is no necessity for getting out of coils or in a position when they must be had on extremely short notice. Certainty there would not be could the purchasing agent and the storekeeper anticipate the effects of a thunder storm and would place orders accordingly. But this is out of question, and the fact remains that emergencies will arise in which armature coils and other supplies as well are required on very short notice, and it is a strong point in shop management to be able to supply them quickly and with certainty.

As to the ability to make coils better and freer from defects than those purchased, we hardly believe this a factor that should be considered strongly. It might have been of some moment a few years ago, but at the present time there are so many firms supplying armature coils, and competition for the trade has grown so lively among them, that each has exerted itself to the utmost to devise schemes for bettering their product. We do not believe it probable that a master mechanic who can give but a few moments a day to the making of his armature coils will be able to improve much on the methods of those who spend all of their time upon the one question.

A Long-Needed Improvement

We are glad to be able to record the fact that a contract has at last been let for the complete electrical equipment of the tunnel under the St. Clair River from Sarnia to Port Huron. This tunnel has a long and sinister record of asphyxiations, to which we have been forced to refer in these columns more than once, so that it is gratifying to note that something is at last to be done. From a technical standpoint, the plan for relief is exceptionally interesting as involving the use of single-phase locomotives. The case is not one in which there has been any doubt of the ability of direct-current locomotives to do the work, and the delay in equipping the tunnel electrically is not in the least degree extenuated by the previous lack of alternating-current apparatus. That this apparatus should have been chosen by an experienced engineer in preference to the well-tried direct-current system, and in a case where the distribution is not extensive enough materially to handicap the latter in cost, is a most significant fact. The service, too, is especially severe, since the entire service of the Grand Trunk

Railway, freight and passenger, has to pass through this single-track tunnel with its slopes toward the center of the river, and the power station load will consist essentially of a series of formidable peaks as the successive trains are pulled out of the tunnel on the up grade. The only steady load will be a considerable amount of pumping and lighting.

As we understand the situation, the advantages of a. c. and d. c. traction in this case were very thoroughly considered, the former showing a sufficient economy in distribution to warrant its choice in view of certain collateral advantages. Perhaps the most important of these latter was the smoothness of the a. c. regulation by transformer taps in the work of accelerating heavy freight trains on the up grades. The work in the tunnel and its approaches will in fact consists very largely of rather formidable acceleration, so that the matter of speed control assumes here an unusual and disproportionate importance. A collateral advantage was the ability to use three-phase induction motors for the pumping, the intention being to use three-phase generators in the power station. The use of three-phase traction might have proved desirable save for the overwhelming importance of speed regulation and the relatively high power factor of the series-compensated motors. It is very significant that on the showing of these advantages the a. c. equipment was selected, in spite of the lack of experience with a. c. motors on the scale here demanded. Each locomotive is to have three driving axles, each equipped with a 250-hp a. c. motor, and the draw-bar pull specified is 25,000 lbs. up a 2 per cent grade at a speed of 10 m.p.h. This means a powerful locomotive, especially since two or more such machines can be coupled together and worked on multiple control. Entrusting such important service to these locomotives means abiding faith in a. c. traction on the part of the engineer, and a few more contracts of such sort will shake up the heavy traction business in rather startling fashion. At the present moment the important thing to be found out is the actual performance of the large a. c. motors. All the data yet available, and they are rather meager, have been from the few a. c. roads now in operation which are equipped with motors of only moderate power. No one has yet openly stated the difficulties which have been encountered in this preliminary work, but the mere fact that there has been no well defined line of criticism made evident is fairly good proof of rather satisfactory performance. Hence, while we are disposed to take a somewhat conservative view of the matter, we have no reason *a priori* to distrust the operative success of an equipment like that now chosen for the Sarnia tunnel. Its choice under skilful and unbiased advice, on a difference of cost that can hardly have been of itself decisive, surely indicates favorable results in sight. At all events, a particularly unpleasant and dangerous tunnel will now be made safe.

The Automobile and the Trolley

Every now and then some enterprising promoter seeks to beguile the public ear with a wonderful tale of the enormous profits to be made by substituting automobiles for trolley cars in urban service, and it is to be feared that the resulting stock subscription list does not always represent that mature analysis of the situation which hard-headed business sense dictates. We have many times pointed out the obstacles which lie in the path of rapid transit automobilism on a commercial scale, and would hesitate to refer to the subject at this time were it not for some exceptionally convincing figures which have come to hand. Then, too, the spring season is already hinting its approach in the automobile trade, with all its possible enthusiasms as the "1906 models" swing into line, and surely a word of caution on the financial problem is not out of place to any of our persuasive but misguided friends among our readers who have figured it all out that by 1910 the trolley car will be a curiosity and the power house a temple of cobwebs.

In actual experience it is difficult to persuade an automobile enthusiast that interest and depreciation cannot be dodged, even with the most flexible steering gear in devil-wagondom. Figures of operating cost are available without end in automobile circles, but there is usually a tendency to limit these to the cost of gasoline, oil and waste per car-mile, instead of including the burdensome items of maintenance which both touring car and runabout impose. Many a man buys a machine on the guarantee that it will cost but 1 cent per mile to run it, only to find that this figure covers fuel and supplies alone.

An actual case in which the costs were carefully kept was that of a touring car representing an original investment of $2,500, a machine built by one of the best known American makers and operated with scrupulous care during 1905. The car held four persons with comfort, and mileage records were tabulated after each run. The total mileage was 2500, and the operating and maintenance expenses were as follows: Oil, gasoline and waste, $37; tire replacements, $88; tire repairs, $19; other repairs, $71; total, $215, or 8.6 cents per car-mile. The cost per passenger-mile, assuming five passengers, is 1.7 cents. Comparing this with an ordinary 25-ft. double-truck trolley car, seating thirty-six passengers, and costing for operation and maintenance the extreme figure of 20 cents per car-mile, the passenger-mile operating cost comes to less than .6 cent. In actual street railway practice the operating cost per passenger-mile runs, of course, much higher, for the reason that a very small percentage of the car capacity is utilized on the average throughout the year, but the same sort of reasoning would apply with equal force to any automobile capable of seating as many passengers as the competing trolley. No account of standing passengers is figured in the above, and allowance for them would reduce the passenger-mile cost still further.

Turning to the fixed charges, the trolley car has the best of the game at the outset. The first cost per seated passenger is far below the automobile figure, and would probably remain on the same side of the line even with the largest commercial motor car likely to be handled in city service. Assuming the two to be equal, however, the question of depreciation decides the matter in favor of the trolley. Certainly no experienced engineer would allow less than from eight to ten years' life in figuring the depreciation charges upon a modern urban trolley car. The allowance to be made for the automobile is difficult to estimate, but we believe that the man who buys a machine with the idea that its life will greatly exceed five years in the present state of the art is more enthusiastic than wise. Even if the motor car is not beyond the pale of useful operation at the end of this time, there is little doubt that the improvements of the near future will have a powerful influence in relegating present-day automobiles to the domain of the obsolete. In a nutshell, the steel rail is the secret of economical transportation upon land; without it, operating expenses are certain to leap far upward, and it is a serious question if the hundreds or thousands of motor cars necessary to replace the trolley in any large city can ever handle in an equal time the volume of traffic which can be carried over the definite right of way which the modern railway track provides.

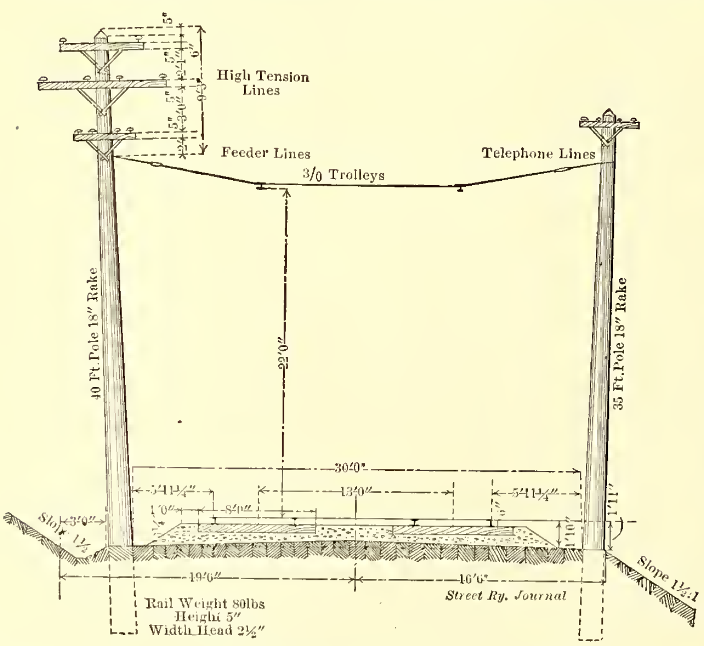
EXTENSIONS AND IMPROVEMENTS ON THE CHICAGO & MILWAUKEE ELECTRIC RAILROAD

The past year has been a period of reconstruction, extension and improvement in all divisions of the Chicago & Milwaukee Electric Railroad. The line has been extended to Kenosha and to Rockefeller; grades and curves have been removed from the old portion of the road; new rolling stock has been added to the equipment; stations have been built along the line, and a new operating office has been erected at Highwood. Much of this work was begun more than a year ago, but the greater portion of it has been carried out under the direction of A. L. Drum, who assumed the office of general manager of the road early in the spring of 1905.

THE NEW OFFICE BUILDING AT HIGHWOOD

THE NEW OFFICE BUILDING

All of the operating offices of the road are located in the new office building, completed a few months ago at Highwood. The building, which occupies a site just south of the car repair shops and present power house, is of brick, and its exterior appearance resembles greatly a Colonial residence. At the present time the tracks run along the rear side of the building, but when they are straightened at this point they will pass along the west side or front.



STANDARD CROSS-SECTION OF LINE ON EXTENSIONS

On the first floor to the right on entering the central hall is the general manager's office. To the left are those of the superintendent and superintendent of transportation, the despatchers' room being between these two offices. In the rear of the general manager's office are reading and smoking rooms for trainmen. The reading room, in addition to being supplied with technical magazines, contains several cases of books, which may be drawn out and taken from the building under rules similar to those prevailing in public libraries. The auditor's and cashier's offices are in the northeast corner of the building, the cashier's office containing a window opening into the hallway through which conductors make their returns.

The second floor is occupied largely by the engineering departments; the offices of the electrical and civil engineers occupy the south half of this floor. Adjoining these offices are drafting rooms, well supplied with natural light through skylights. The offices of superintendent of motive power, claim agent and general superintendent of construction occupy the north half of the second floor. Very extensive facilities for blue printing and photographic work are provided on the third floor. The blue print room contains a Eugene Dietzgen vertical blue printing machine, and, in addition, runways are provided through the windows to carry frames for printing by natural light.

A well-equipped gymnasium occupies one-half of the basement floor. Parallel bars, vaulting horses, mats, dumb-bells, Indian clubs, boxing gloves, punching bags, a rowing machine and similar gymnasium apparatus are provided. The north half of the basement contains locker, bath and toilet rooms for trainmen, the bath room containing both shower and tub baths. In addition to the indoor gymnasium, tennis courts, trapeze, horizontal and vaulting bars, and facilities for hammer throwing, and for carrying on other similar sports are provided outside in the vicinity of the building.

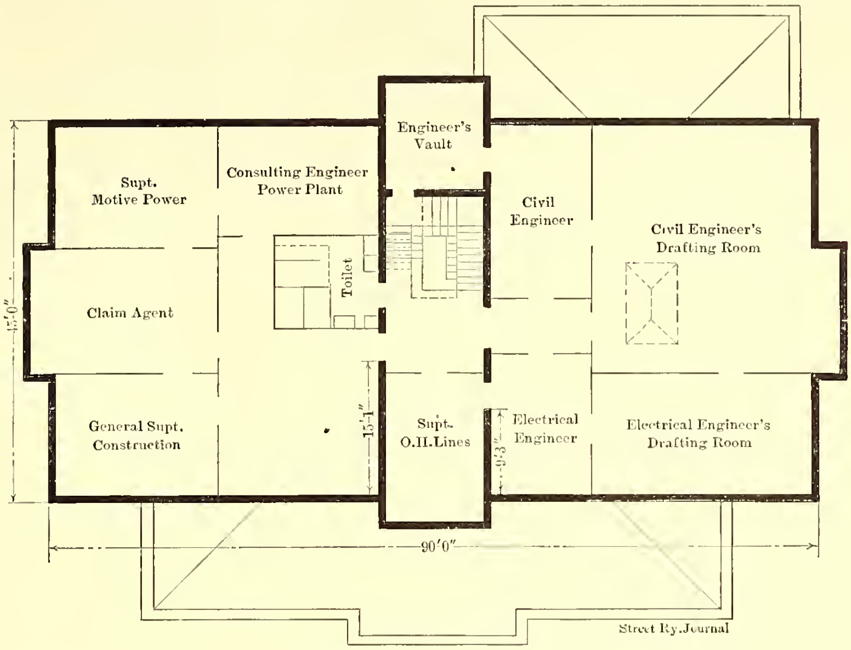
Fireproof vaults are constructed on all of the floors. In the vault in the basement, articles found on cars are stored. That on the first floor is adjacent to the cashier's office, and is used largely for the storage of tickets. The vault immediately above is equipped for the storage of tracings, field books and engineering data in general, while the vault on the top floor is for the use of the claim agent. The furniture, which includes Globe-Wernicke filing cabinets for each department, has been obtained to match the interior finish of the building, which is of oak.

INTERIOR OF GYMNASIUM

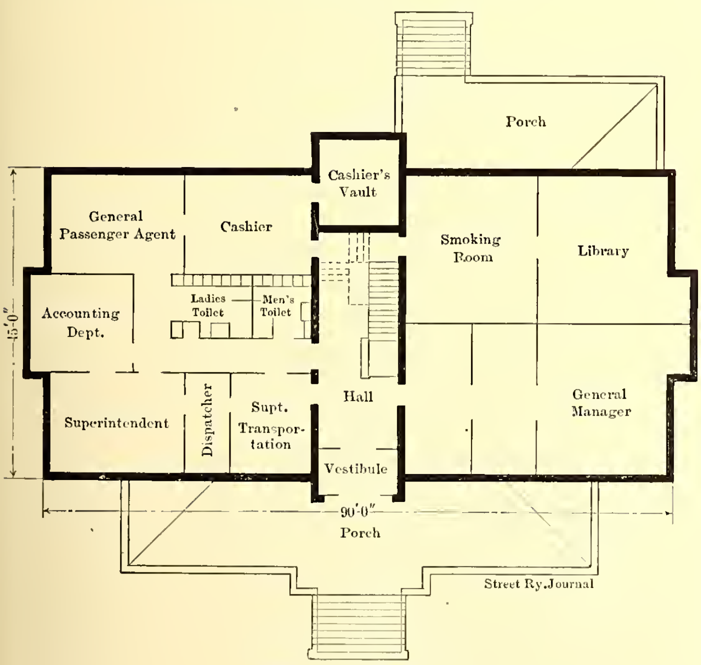
TRACK IMPROVEMENTS AND EXTENSIONS.

Although the road was originally organized to operate between Chicago and Milwaukee, it has for several years past extended only from Evanston on the south to Waukegan on the north, a distance of about 25 miles. About two years ago an extension from Lake Bluff on the main line west to Rockefeller was opened up. This extension, which is about 8 miles long, penetrates a region where several small lakes are found. In addition to caring for the summer travel to and from the lake regions, this west branch was constructed partly with the idea of developing at some future time a heavy freight service, as the extension taps the Chicago, Milwaukee & St. Paul and E., J. & E. Railroads at Rondout and the Wisconsin Central Railway at Rockefeller. In order to afford better service when freight traffic is developed, the tracks are laid double to Libertyville.

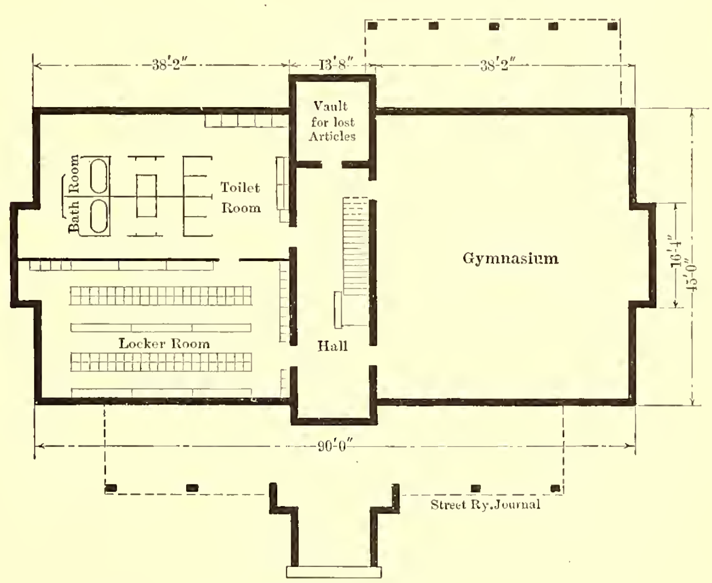
During the past season an extension, which represents the highest type of electric railway track construction, has been constructed from Lake Bluff to Kenosha. The new line was built on the west side of the tracks of the Chicago & Northwestern Railway, and as the old line to Waukegan is on the east side, the system has four tracks between Lake Bluff and Waukegan. The west division will be used largely for freight and passenger express service, while the old tracks will continue to accommodate local passenger service. At the present time one track is laid the entire distance to Kenosha, and the work of completing the second track is being pushed rapidly and will be completed in a few weeks. Between Waukegan and Kenosha right of way has been obtained, all abutments over crossings have been built and other provisions have been made for four tracks.



SECOND FLOOR PLAN.



FIRST FLOOR PLAN



BASEMENT PLAN

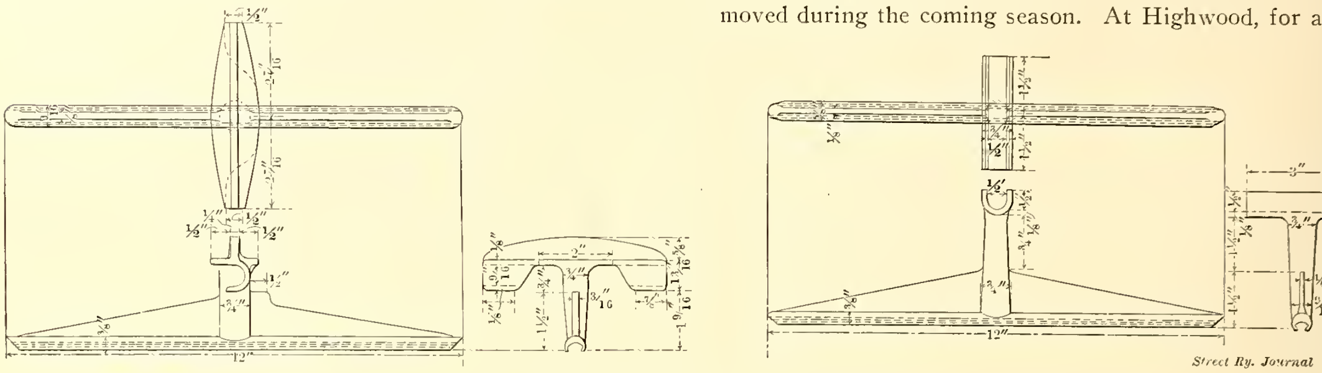
PLAN OF OFFICE BUILDING AT HIGHWOOD

One of the accompanying drawings shows the track and overhead construction on the new extensions. The track is laid on a bed of gravel, having a depth of 12 ins. at the crown, the earth below the gravel sloping away on either side of the crown to facilitate drainage. The rails are laid in 33-ft. lengths, and continuous rail-joints are used. These cover concealed, soldered bonds of the Flexible Mesh Rail Bond Company type. The peculiar feature of these bonds is a copper mesh over the terminal of the bond, which retains the solder by capillary attraction and reinforces the solder as mesh in wire cloth or steel in concrete.

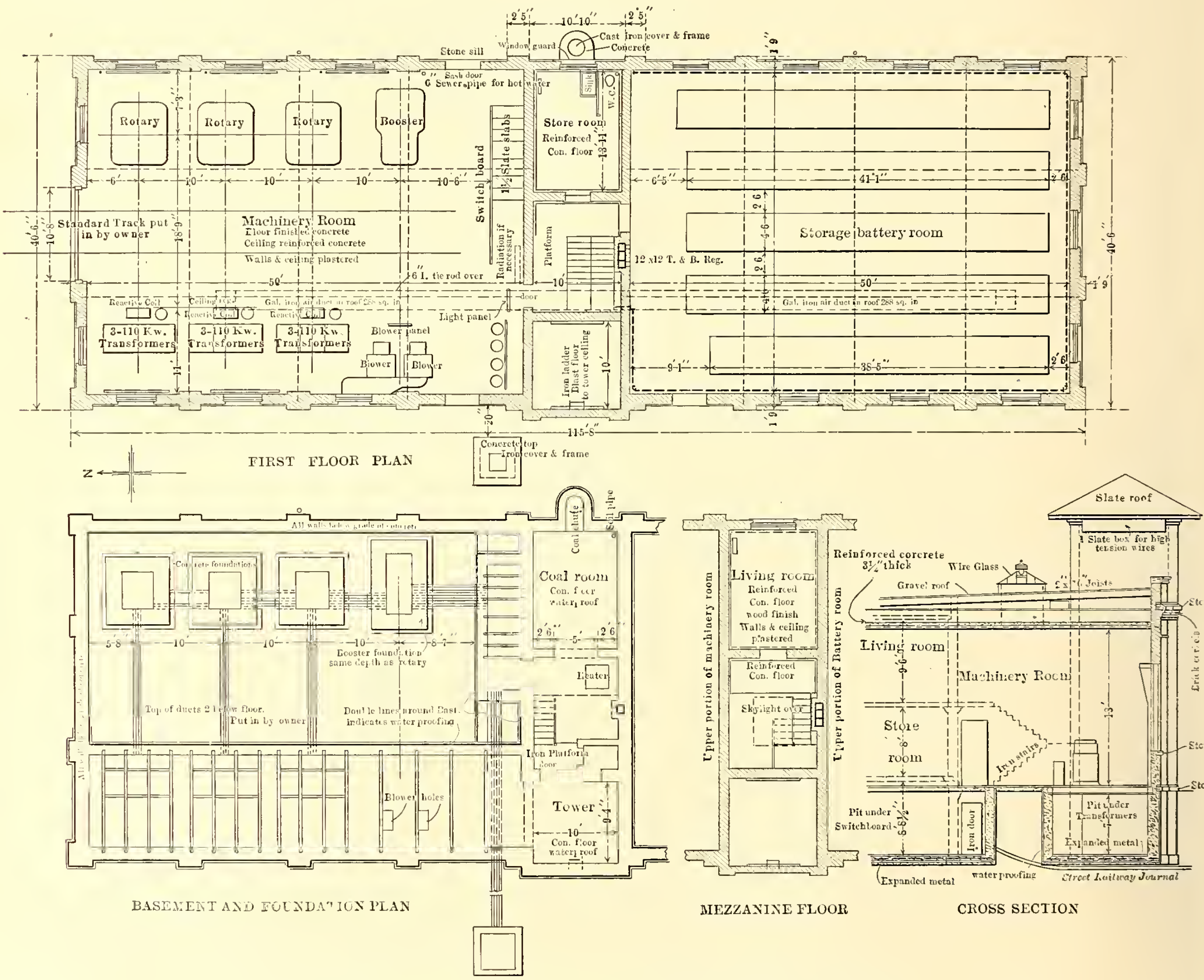
The tracks are placed with centers 13 ft. apart. Span wire construction is used throughout, the poles being placed 30 ft. apart. These are of white cedar with 8-in. tops, and are set with a rake of 18 ins. Those on one side of the track are 35 ft. high, and carry above the span wire one cross-arm, on which telephone wires are strung. Poles 40 ft. long on the opposite side carry three cross-arms. The two upper ones support the high-tension circuits, the separate wires of which are placed 36 ins. apart. Some distance below the high-tension cross-arms, the third arm carries direct-current feeders of 500,000-circ.-mil capacity. The trolley is of No. 000 copper, and is placed 22 ft. above the track.

The drawing on the next page shows the combination trolley ear and hanger employed. This is cast of brass in one piece, and no insulation is placed between the trolley and the span wire. Wood strain insulators, placed in the span wires near each pole, provide proper insulation. The hanger was designed by J. F. Scott, superintendent of overhead lines of the system. It may be noted that by its use both trolley wires of a double-track line serve as feeders for a car on either track, and thereby diminish the line loss. The greatest advantage of this construction, however, is its rigidity. There is practically no danger of the ear breaking loose, and no trouble has been experienced in this direction since the hangers were installed.

This north extension, from Lake Bluff to Kenosha, has been built with all the requirements for high speed. The whole division is practically one tangent. There are only two 1-deg. curves in the entire distance, and there are no grades of any consequence. The track and pole line are well shown in the illustration on page 107. In very many instances overhead crossings are made at highways. The abutments for these as well as for the culverts under the tracks are of concrete. The line is built through the western limits of all the towns and on a private right of way 100 ft. wide, so that speed will not be limited by the passing of ordinances.



DETAILS OF GROOVED TROLLEY EAR



PLANS AND SECTION OF NEW SUB-STATION SOUTH OF KENOSHA

Considerable work has been done in straightening double tracking and improving the old portion of the road between Evanston and Waukegan. As originally built, this line contained numerous sharp curves and several heavy grades. Practically all the curves of small radius, with the exception of those in the towns, have been removed. Others will be removed during the coming season. At Highwood, for about ½ mile on each side of the power house and shops, the location of the tracks will be changed some distance to the west of their present position. They now follow the highway, but a new private right of way has been acquired paralleling the tracks of the Chicago & Northwestern Railway. Four curves will be cut out, seven stops avoided and the distance shortened considerably when the new route is completed.

With the exception of a short stretch in one of the towns, double tracks have been laid the entire distance between Evanston and Waukegan. Over a distance of several miles new tracks were constructed on what was originally a highway. In order to obtain a wide right of way at a point above Lake Bluff, the company acquired a strip of ground several miles long to the east of the old tracks, built a 60-ft. gravel highway upon it and then placed tracks on the ground formerly occupied by the old highway.

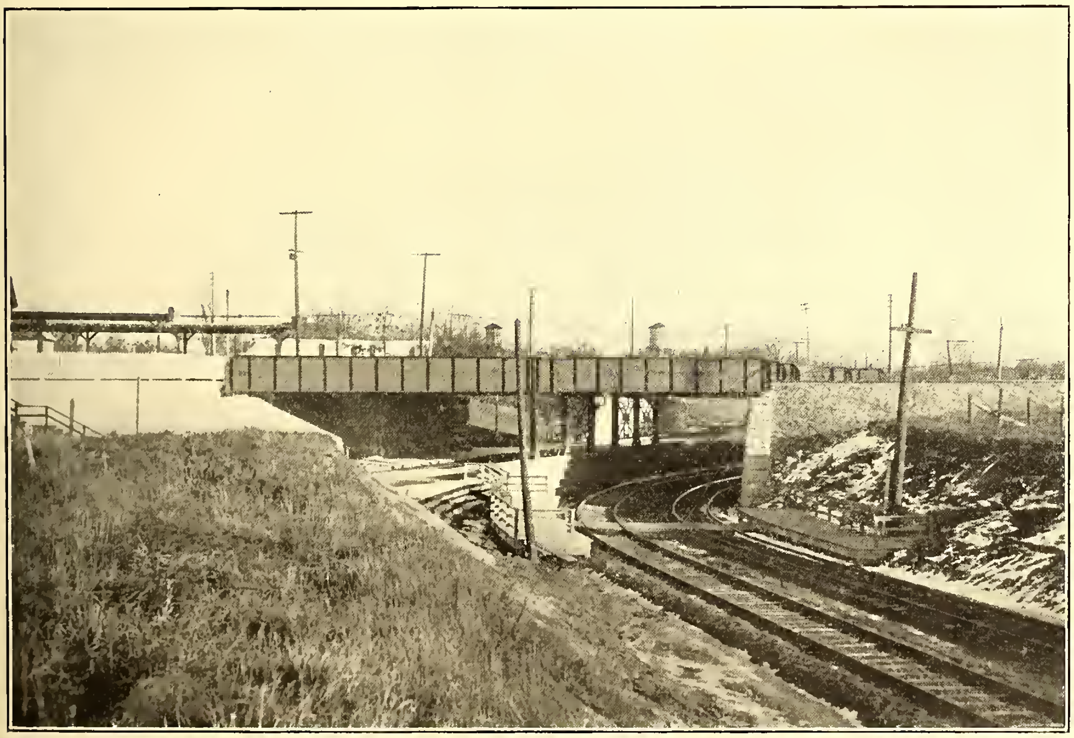
THE POWER HOUSE AND SUB-STATIONS

At the present time power is developed in the station at Highwood. Sub-stations are located on the main line at Winnetka, North Chicago and at a point a few miles south of Kenosha, and at Libertyville on the west branch. It may be remarked that this was the first system to employ the method of distributing power by high-tension a. c. lines from a central station to outlying sub-stations. The power station has a total machine capacity of 2815 kw, the largest machine being a 1500-kw unit, installed about one year ago. Of the total station capacity, 525 kw is in direct current for use on the lines in the immediate vicinity.

Plans are now being completed for a new power house and a complete overhauling of the high-tension distributing system. The new generating station, in the plans of which provisions are made for an ultimate capacity of 45,000 kw, will be erected most probably at Waukegan. This will be the central point of the system when contemplated extensions to Milwaukee are completed. The first portion of the station constructed will have a capacity for two 3000-kw and two 5000-kw General Electric turbo-units. The two of 3000-kw will be the only ones installed for the present. Additions will be made as the service demands.

The turbines will be located in a single line down the middle of a central bay. An extension on one side will contain two rows of boilers, the coal bunkers being placed above the passage between the lines of boilers. Bus-bar structures, high-tension motor-operated oil switches and the operating room will be located on that side of the central bay opposite the boilers. A bay window in the operating room will overlook the turbine room. Current will be transmitted to sub-stations at 33,000 volts. In addition to the sub-stations now in operation, plans provide for the erection of one at Racine and one near Milwaukee, each to be of 1000-kw capacity. Another will be built at Highwood to replace the direct-current machines now being operated in the power house.

EXTERIOR OF NEW SUB-STATION

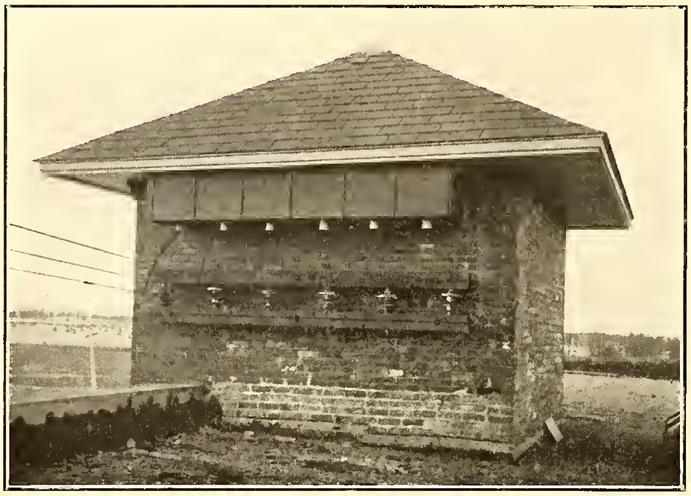


THE ROCKEFELLER DIVISION CROSSING, UNDER THE CHICAGO & NORTHWESTERN TRACKS AT LAKE BLUFF

The new sub-stations will be similar in design to that one just completed south of Kenosha, the illustration of which shows the building to be a brick structure comparatively free of ornamentation. A storage battery occupies the south half of the building, while the northern portion contains the rotary converters, transformers and other apparatus. The interior walls, as well as the ceiling, are plastered and painted a dull yellow. Lighting is accomplished by incandescent lamps placed near the ceiling and provided with shades, and a hot-water heater in the basement supplies heat to the building. The converter room is served by a hand-operated crane of 5-ton capacity.

The high-tension lines enter the central tower in a manner well shown in the reproduction on page 106. Entrance is made through the under side of a slate box. The circuits, when once inside the tower, descend along the wall, and after passing through the choke coils of lightning arresters drop to the basement. When the stations north are completed, these circuits will return to the top of the tower along the north wall, making their exit in a manner similar to their present method of entering. Disconnecting switches will be inserted, so that the northern portions of the line may be cut off from the power house should a ground short-circuit or other trouble occur.

At the present time the installation of transformers and converter and other apparatus is temporary. The high-tension lines after passing into the basement go to a hand-operated oil switch. From this they lead to the three 185-kw air-cooled transformers. The rotary converter is of 500-kw capacity, and is of the General Electric manufacture. It is started from the a. c. end, the shunt fields being open-circuited at several places when this is done. Intermediate taps from the low-tension side of the transformers give low voltages for starting.



TOWER OF SUB-STATION

NEW WAITING STATION AT LAKE BLUFF

A switchboard containing seven panels is located at the southeast corner of the room. All the leads between the switchboard, transformers and other apparatus are carried underneath the floor in vitrified tile conduits. Two bare ground return wires, each of 550,000-circ.-mil capacity, are carried underground in concrete conduits to the tracks about 100 ft. distant from the station. The two lead-sheathed d. c. feeders are also placed underground. These ascend a trolley pole near the station, to the cross-arms, and are then carried one in each direction.

The ultimate capacity of the State Line station will be 1000 kw. Oil-cooled transformers controlled by motor-operated oil switches will be installed. The present voltage of the high-tension line entering the station is 13,200 volts, but this will be raised to 33,000 volts when the contemplated improvements are completed.

NEW PASSENGER STATIONS

In all, more than thirty new passenger stations have been erected. These vary in size according to the requirement, and although the greater number of them are constructed along the same general lines, the architecture is varied sufficiently to prevent a monotonous appearance.

One of the most complete stations is that at Libertyville on the west extension from Lake Bluff. This station was built at a cost of $12,000. The rear portion is occupied by a rotary converter sub-station, while living rooms for the station agent are provided in the second story.

Quite an elaborate station will be built at Zion City during the coming season, the foundations being already constructed. The station platform will have a total length of 252 ft. The waiting room, which will occupy the central portion of the building, will be provided with an elaborate brick fire place at each end. The ticket office will be located at the middle point of the waiting room, immediately under a central tower. An extension to the north of the waiting room will contain an express office, men's toilet and baggage room, while the ladies' retiring room will be at the opposite end of the station. The building will be of brick, with shingle roof, the gutters and cornices being of copper, and will cost approximately $25,000.

The greater number of the new stations, however, were constructed much after the style of that one at Lake Bluff, shown in the accompanying reproduction. The enclosed portion measures 24 ft. x 12 ft. At each end the canopy covers a platform 24 ft. long. A platform 6 ft. wide extends in front of the enclosed room. The rafters over both the interior and exterior portion are ceiled, and the interior walls of the waiting room are finished in a similar manner. The shingle roof is painted deep red, while the walls and posts are given a coach green color. A few stations are built with the waiting room at one end. The canopy roofs over some of the narrower ones are supported by a single line of posts, and while the architecture of the stations is of the same general style, slight changes are made as the location of the station may require. A station of rather odd shape is the one a short distance below Glenco, and shown in one of the accompanying illustrations. It is but about 4 ft. wide, this narrow width being necessitated by the restricted right of way.

NEW WAITING STATION AT GLENCO

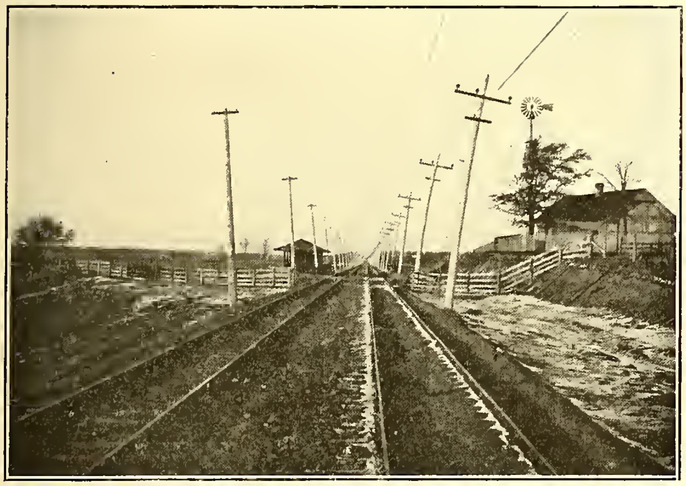
In some instances similar stations are erected on each side of the track. At other places only a platform and a canopy are erected opposite a station, and at some of the smaller places the platform alone is constructed. The stations are all lighted by incandescent lamps connected to the trolley, and the smaller ones will most probably be supplied with electric heaters.

At many points a great deal of attention has been given to beautifying the grounds around the station. At Libertyville more than $1,000 was spent in planting flowers and shrubs. The grounds at many other stations will receive similar attention during the coming season.

THE MOTIVE POWER DEPARTMENT

The car equipment, as well as the power house and sub-stations, are under the immediate charge of J. L. Matson, who assumed the office of superintendent of motive power in the spring of last year. The present rolling stock for passenger service consists of thirty-four closed motor cars, ranging in length from 36 ft. 11 ins. to 46 ft. 7 ins., and twenty-five trailers for summer service, the greater number of which are 52 ft. long. There are also fourteen smaller motor cars.

Ten of the larger cars are of the St. Louis World's Fair type.



VIEW ON EXTENSION TO KENOSHA

A few changes, such as the addition of steps, were necessary before they were adapted to the present service. These ten cars, and likewise several of the others, are equipped with General Electric type M control, while the smaller cars are supplied with K-14 controllers. Motors of the General Electric type No. 70 are mounted on the trucks of the old World's Fair cars. The remainder of the large cars are provided with either four GE 57 motors or GE 74 motors.

Within a short time this equipment will be supplemented by ten cars now being built by the Jewett Car Company. The new cars are to be 52 ft. long and will seat fifty-six people. A smoking compartment will occupy the forward portion of the car, a glass partition being placed between the smoking and passenger compartments. The General Electric type M control will be employed. The trucks will be mounted with four General Electric 73 motors.

The equipment is cared for at the shops near the power house and office building at Highwood. Several additions and improvements are being made to the shops. A brick and steel storage shed and a four-fire blacksmith shop have been erected, and some machine tools have been added to the shop equipment, among them a 48-in. Niles wheel lathe. Overhead travelers and pit jacks have been installed to facilitate the handling of armatures, and other minor improvements have been made. When the present power house is abandoned, however, several of the departments of the shop will occupy the vacated building, and because of these contemplated changes, the present shops are not being equipped as they otherwise would be.

During the past year an unusual amount of work has been done in the shops. All the wheels under the twenty-five trail cars have been changed, wheels of standard interurban section being substituted for wheels with 2¼-in. tread. Chilled wheels have been removed from under all the motor cars and either steel-tired, forged or rolled-steel wheels substituted. Trucks under several of the cars have also been rebuilt. During the past summer all of the bodies of the passenger cars were overhauled and painted. In addition to this work, the ten cars formerly operated at the World's Fair were received and put in running condition.

HOT-WATER VS. ELECTRIC HEATING

In the booklet recently issued by the Chicago City Railway Company descriptive of its new standard car, the following data concerning the cost of hot-water and electric heating of cars are given. These figures were used in deciding upon the method of heating to be employed in the new cars. The results show 7 cents per day per car in favor of electric heating, and this method was adopted:

Average hours per car per day, 9.
Average current per car, 12 amps.
Weight of electric heaters, 360 lbs.
Weight of hot-water heaters, 1454 lbs.
Coal consumed by hot-water heaters, 80 lbs.
Price of coal, $8.00 per ton.
Price of electric heaters, $80.00 per car.
Price of hot-water heaters, $140.00 per car.
Repairs on electric heaters, 5 cents per car per day.
Repairs on hot-water heaters, 10 cents per car per day.
Attendance on hot-water heaters, 10 cents per car per day.
Average miles per car per day, 100 miles.
Average heating season, 150 days.

Upon this assumption, without going through the calculations in detail, the result may be summarized as follows:

ELECTRIC HEATERS

Cost per day of heating season using electric heaters:

	Cents
12 amps., 9 hours = 54 kw-hours per day, at .992 cents......	53.6
Interest at 5 per cent, plus depreciation at 7 per cent, on $80.00, cost price of heaters 365 days, divided by 150 days heating season	6.4
Hauling dead weight, 360 lbs., 100 miles per day, 365 days per year, at 0.95 cents per day of heating season...........	4.2
Repairs at 5 cents per car per day...........	5.0
Interest 5 per cent, plus depreciation 3 per cent on additional copper required for electric heaters per day of heating season	3.8
Total cost per car per day...........	73.0

HOT-WATER HEATERS

Cost per day of heating season using hot-water heaters:

	Cents
80 lbs. coal, $8.00...........	32.0
Interest at 5 per cent, plus depreciation at 7 per cent, $140.00..	11.2
Hauling dead weight, 1454 lbs., 100 miles per day, 365 days in year, per day of heating season...........	16.8
Repairs	10.0
Attendance	10.0
Total cost per car day...........	80.0

MT. LOWE TRAFFIC RESUMED

The efforts made by the officials of the Pacific Electric Railway Company, of Los Angeles, to repair at once the damage to the incline railway done by the recent Echo Mountain fire, were rewarded in the completion of the work on Wednesday, Jan. 3, on which date traffic was resumed to Mt. Lowe. Right after the fire a force of 200 workmen was put to work building the upper part of the incline and in grading Echo Mountain. It is now proposed by the company to locate on Echo Mountain a great pleasure resort, although the work will probably not be commenced for several months.

SINGLE-PHASE ELECTRIC LOCOMOTIVES AND POWER EQUIPMENT FOR THE SARNIA TUNNEL

A short notice was published in the last issue of the STREET RAILWAY JOURNAL of the award of the contract for electrical locomotives for hauling the trains of the Grand Trunk Railway system from Sarnia, Ont., to Port Huron, Mich. This contract is the result of a long study of the conditions by the Grand Trunk management and its electrical engineer, B. J. Arnold, and the decision to adopt electricity was reached from the desire both to eliminate the use of combustion engines in the tunnel and also to increase its capacity. A profile of the tunnel, which contains a single track only, is given in Fig. 1.

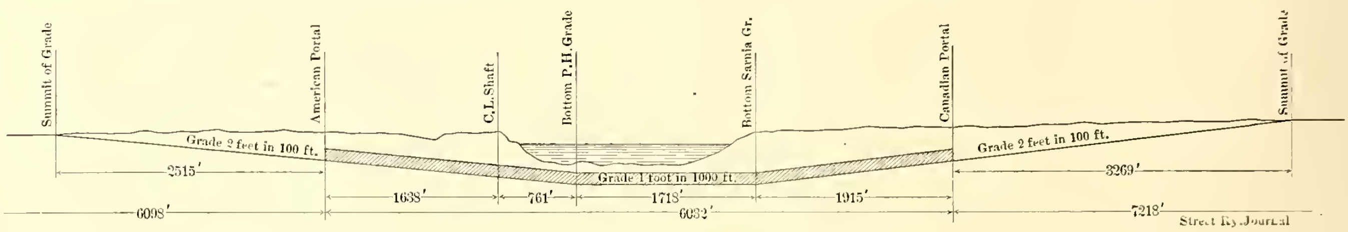


FIG. 1.—PROFILE OF TUNNEL

The tunnel proper is 6032 ft. long, and of this length 1718 ft. are under the river bed. This portion of the tunnel is practically level, as the grade is only 0.1 per cent, or just sufficient for proper drainage. The rest of the tunnel is built on a 2 per cent grade, of which 1915 ft. are on the Canadian side and 2399 ft. are on the American side. The grade of 2 per cent is continued from the Canadian portal of the tunnel for a distance of 3269 ft., and from this point the tracks are practically level. The electrical equipment will extend through the yards from this point for a distance of 3949 ft. On the American side, the 2 per cent grade continues from the portal of the tunnel for a distance of 2515 ft. The electric section will extend thence to the end of the yards, a distance of 3583 ft., which is also level. The linear distance to be equipped with electric power is therefore 19,348 ft. Although the tunnel is single track, the tracks on the approaches are double up to a point within about 300 ft. of each portal.

At the present time, as stated, the trains of the Grand Trunk Railway are hauled through the tunnel by steam power. Especially designed steam locomotives, which burn anthracite coal, are used. These engines are designed to haul trains of 820 tons weight, but owing to the varying condition of the climate, the rail is affected from time to time, so that the average weight of train which these locomotives actually haul is about 750 tons. For this reason it has been necessary to split up a great many of the trains which arrive at the tunnel portal, and this has congested traffic at the terminals. Owing to the more uniform draw-bar pull of electric locomotives, it is expected that longer trains can be hauled, although the length of the trains will be naturally limited by the strength of the draw-bars on the ordinary freight trains when ascending the 2 per cent grade. As it has been considered desirable to limit this strain to 50,000 lbs., the trains to be hauled by the electric locomotives will be limited to 1000 tons each. Heavier trains must be divided or sent through with locomotives in front and behind.

The service requires that each electric locomotive unit shall take a train of 500 tons, or two units a train of 1000 tons, through the tunnel block from summit to summit in 15 minutes, under the following conditions:

It will be coupled to the train on a level track at a point 1200 ft. from the summit, and must accelerate it up to a speed of 12 m.p.h. in 2 minutes, at the end of which time it will have reached the summit of the grade leading down into the tunnel. It will then run down a grade of 2 per cent to the level track in the tunnel at a speed not exceeding 25 m.p.h., continue on the practically level stretch under the river, and then draw the train up a 2 per cent grade at the rate of 10 m.p.h. to the level track beyond the tunnel approach on the other side. It must then gradually accelerate the train until a speed of 18 m.p.h. is reached. Each unit must be capable of exerting a tractive effort of 25,000 lbs. for a period of 5 minutes, in addition to the energy required to accelerate the train at the starting point, and to run with it into the terminal yard. From this point it must immediately run back to a position 1200 ft. from the summit, couple to another train and be ready to start through the tunnel in the opposite direction. It must therefore make a run of the character described every 30 minutes.

It is obvious that a service of this kind will produce an intermittent load on the power station in which the current demand of a locomotive drawing a train up the 2 per cent grade, or approximately 1200 kw, is superimposed upon that of the locomotive starting from the yard. On the other hand, there will be periods of no power demand lasting from 6 to 7 minutes when the train is descending the 2 per cent grade and coasting on the level. This locomotive load is graphically shown in Fig. 3.

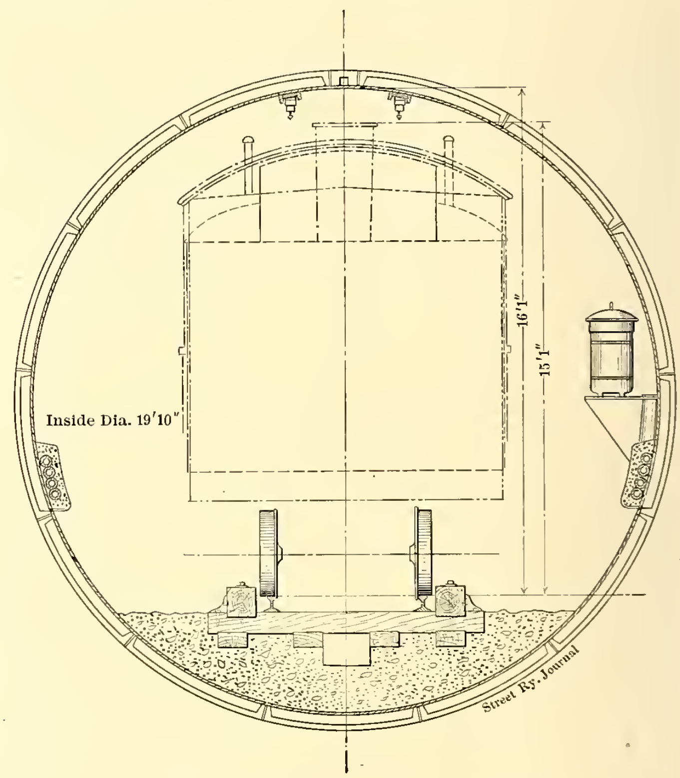


FIG. 2.—CROSS-SECTION OF TUNNEL

As stated last week, the Tunnel Company also proposes to install a pumping and lighting system. The former is designed to take care of the rainfall in the cuts at the two approaches, as well as the small amount of water in the tunnel due to seepage and condensation. The pumps will be operated by three-phase motors, and those at the Sarnia portal will have a capacity of delivering about 11,000 gals. of water per minute against a 90-ft. head. The pumps at the Port Huron portal will have a capacity of delivering about 8000 gals. per minute against a 75-ft. head, and the drainage pumps in the tunnel a capacity of about 150 gals. against a 40-ft. head. In addition, two small pumps, with a capacity of 150 gals. per minute against a 90-ft. head, will be installed at the foot of the pump shaft near the Sarnia portal. As it is important that the tunnel should be kept free from water at all times, the pumps installed at each portal will consist of duplex units throughout. The tunnel will also be lighted by incandescent lamps from independent three-phase feeders. These lamps will be connected four in series on 440-volt mains, and will be installed in a single row on each side of the tunnel about 10 ft. above the top of the rails, and will be spaced 25 ft. apart in each row.

The introduction of electricity will increase the capacity of the tunnel from 12,000 1000-ton trains per year to 35,000 1000-ton trains per year.

The single-phase electric locomotives, which will be supplied by the Westinghouse Electric & Manufacturing Company, will be in three pairs of two units each. Each unit will weigh approximately 62 tons, and, as stated, will develop a draw-bar pull of 25,000 lbs. on a 2 per cent grade at a speed of 10 m.p.h. It is of the rigid frame type, with driving axle boxes held in the same frame that contains the draft gear. It will be mounted on three pairs of driving wheels, which will sustain the entire weight, distributed by equalizer bars similar to those used in steam locomotive practice; will have an outside frame supported on semi-elliptical springs, and will be equipped with Westinghouse combination automatic and straight air and American driver brakes will be used. The air supply will be provided by a two-cylinder motor-driven air compressor having, with a 5-in. stroke and a speed of 190 r. p. m., a capacity of 45 cu. ft. of air per minute. Air reservoirs, signal outfits, whistle, bell with pneumatic ringers, automatic pump governor, tools, instruments, gages, headlights, push poles and other details complete the auxiliary equipment.

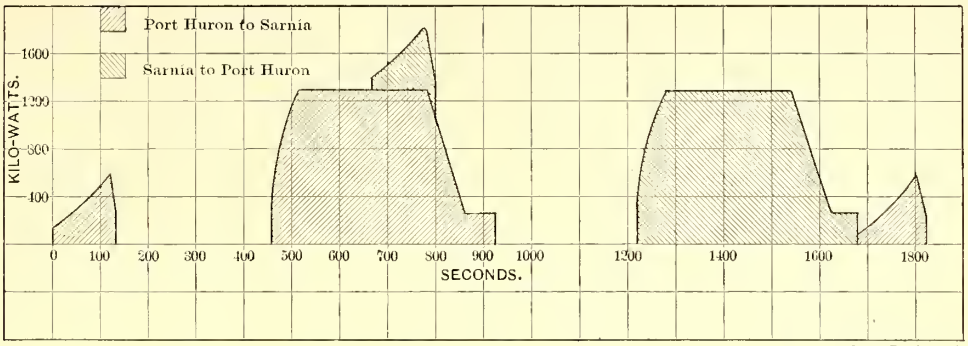
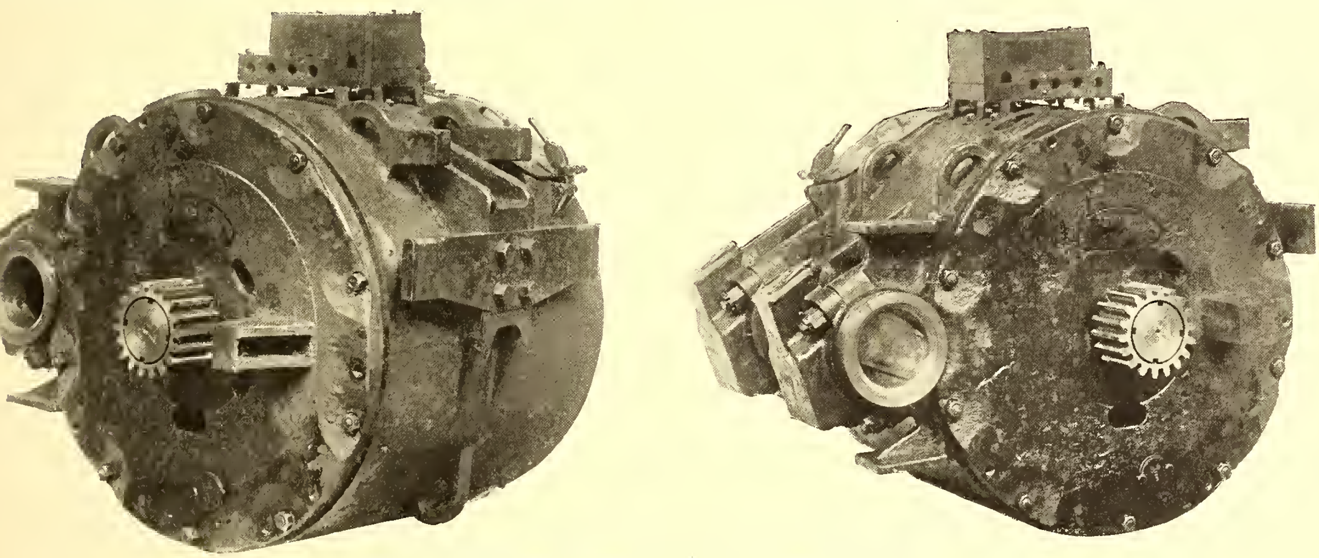


FIG. 3.—CURVE SHOWING POWER REQUIRED BY A. C. LOCOMOTIVES TO DRAW 1000-TON TRAINS THROUGH TUNNEL

A motor will be geared to each axle, giving each unit an aggregate rated capacity of 750 hp. The motors are of the single-phase, compensating type, and will weigh complete approximately 14,500 lbs. The armature will weigh approximately 5600 lbs. The motor frame consists of a steel cylinder type, cast in one piece, and enclosed at the end by brackets of the same material, which carry the bearings and oil reservoirs. The suspension noses and safety lugs form a part of the main casting. Seats for the axle bearings are cast solid with the frame. All bearings are of phosphor bronze, lined with babbitt, and are divided into two parts. They are of exceptionally large dimensions, are arranged for oil waste lubrication, and are provided with large openings on the low-pressure side, giving a thorough lubrication of the entire bearing surface. Oil is fed into the reservoirs through openings separate from the waste pockets, and therefore reaches the waste from below, and is thoroughly filtered before entering the bearing.



FRONT AND REAR VIEWS OF LOCOMOTIVE MOTOR

Westinghouse friction draft gear, M. C. B. automatic couplings, air-sanding apparatus, and bumper steps, front and back. The cab will be of sheet steel, mounted on a frame work of iron, which supports both walls and roof.

The principal dimensions will be approximately as follows:

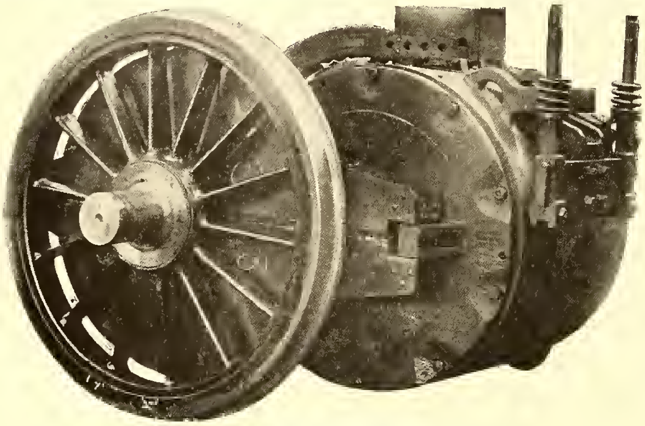
Length over end sills, 27 ft. 9 ins.
Rigid wheel base, 12 ft.
Width over rail, 9 ft. 6 ins.
Height from top of rail to top of cab, 12 ft. 6 ins.
Diameter of driving wheels, 62 ins.

The operating apparatus will be arranged along the sides of the cab, leaving a free passageway 3½ ft. wide the entire length. The cab will be lighted and heated by electricity. The instrument lights will be screened while the locomotive is running.

The motors are swung between the locomotive frame and the driving axles by a flexible nose suspension from two hangers supported by a truck transom, and passing through heavy lugs with helical springs above and below the lug. The motors are held to the axle by means of caps, which are split at an angle of 35 degs. with the perpendicular, so that the greater part of the weight is borne by solid projections from the motor frame, which extend over the axle, rather than by the cap bolts. Large openings above and below provide access to the commutator and brush holders. The field coils are wound with copper strap, insulated between turns and about the coils by mica, and finished by taping and dipping.

In addition to the main coils, the field carries a neutralizing winding, which consists of copper bars placed in slots in the pole faces and joined at the ends by connectors of copper strap, so as to form one continuous winding, which is connected in series with the main field winding and with the armature circuit. The magnetizing effect of this auxiliary winding is directly opposite to and neutralizes that of the armature winding, thus eliminating the effect of armature reaction and improving commutation and power factor. The main coils can be easily removed without disturbing the auxiliary winding.

The armature coils are of copper strap, embedded in slots and cross connected, like the multi-circuit winding of a direct-



MOTOR ON AXLE

current generator. A preventive winding is connected between the commutator and the main coils, introducing a preventive action, which is effective only when the coil is passing under the brush.

During operation, a forced circulation of air, supplied by motor-driven blowers, enters at the rear, distributes itself thoroughly throughout the motor and escapes through the perforated cover over the commutator. This system of forced ventilation of both motors and auxiliary apparatus forms one of the most interesting innovations in electric railway construction. It secures a maximum output from a given weight of material and a high ratio of continuous output to the one-hour motor rating common in railway practice. It also provides effective ventilation while the locomotive is not in operation, as the blower may be driven while the locomotive is standing at the station or the end of the line.

The motors are wound for 240 volts and 25 cycles per second, and have a nominal rating of 250-hp each, on the basis of usual electric railway practice.

The essential elements of the control equipment include the collecting devices, the auto-transformers, the unit switches, the preventive coils, the reverser and the master controllers. A multiple-unit system of control is provided with pneumatically-operated switches and circuit breakers, low-voltage control circuit and other characteristics standard in Westinghouse practice. Any unit may be controlled from either end, and two or more units may be coupled together and operated from a single cab and by a single crew. The tractive effort which can be readily applied to a single train is therefore limited only by the number of units available, and the hauling power is limited only by the mechanical strength of the coupling between locomotive and cars. A control circuit is carried from one unit to the next by means of connecting sockets and jumpers in the usual manner.

Speed control of the driving motors is secured by variation of the voltage at the motors, obtained by means of taps taken from the winding of the auto-transformer, which receives current from the trolley at 3000 volts, and reduces it to 240 volts or lower, according to the tap employed. These taps are connected to unit switches, from which current is led through the preventive coils to the motors. Four unit switches serve to reverse the field of each motor.

The unit switches are of standard Westinghouse design, and are, in effect, pneumatically-operated circuit breakers of great power and reliability. The switch cylinders are controlled by magnetically-operated valves, current for which is obtained from a 50-volt tap from the auto-transformer. The sequence of operation is governed by the master controller in conjunction with a system of interlocks, which prevents short-circuit of the steps between taps from the auto-transformer, or improper operation of the controlling mechanism. At any running point four controlling switches are closed. Through the preventive coils approximately the same amount of current is drawn from each of these switches and the leads to which they are connected. To change to a higher voltage on the motors, the master controller is moved to the next notch, opening the last switch of the group that is closed and closing the switch next higher, with the result that the motor voltage is shifted up one step. By this arrangement the voltage at the motor will be completely under control of the locomotive driver, and may be varied up and down at will without opening more than one-quarter of the load current. Small switches in the circuits to the magnets of the reversing switches will enable any motor or combination of motors to be cut out without disturbing the others.

Every one of the seventeen controlling connections provides an efficient running point. This number is ample to prevent any slipping of the driving wheels due to increase of current from one notch to another. Whether empty or heavily loaded, operated in single or multiple units, torque and draw-bar pull may be gradually applied and the locomotive started without jar.

Each locomotive unit will be equipped with a pneumatically-operated pantagraph trolley to collect current from the overhead lines outside the tunnel and throughout the yards. The proportions of the pantagraph will be such that, when extended, it will make contact with the trolley wire 22 ft. above the rail, and, when closed down, the contact shoe will not extend more than 18 ins. above the roof of the locomotive. The pantagraph will have a broad base, and will be constructed of light and stiff material.

A No. 0000 grooved overhead trolley wire will be suspended from a single 5/8-in., high-strength, double-galvanized, steel-strand, messenger cable by hangers of varying length in such a manner that the trolley wire will be approximately horizontal. The messenger cable will be swung from structural iron bridges located throughout the yards, and are of suitable length to span the proper number of tracks. There will also be a small section of track equipped with a trolley line swung by catenary suspension from bracket arms which are supported on lattice-work poles.

For the operation of the electric locomotives a complete power plant will be installed by the St. Clair Tunnel Company, including two 1250-kw, 3300-volt, three-phase, 25-cycle, 1500-r. p. m., rotating-field, Westinghouse steam-turbine units, with the necessary complement of switchboards, exciters, lightning protective apparatus, etc. This station will also supply the current to light the buildings, yards and tunnel, to operate motor-driven centrifugal and triplex pumps which drain the tunnel and approaches and operate the sewage systems, to run motors in the roundhouses and for other purposes.

The Toledo & Indiana Railway has instituted limited service between Toledo and Bryan. Every other car is a limited. This plan is common to Indiana.

THE QUESTION BOX

As recently announced, in response to many requests, the Street Railway Journal has decided to again institute an open Question Box in its reading columns. The first of the new series of questions was published in the issue of Dec. 9, 1905. The answers will be presented from time to time as they accumulate.

This week methods for increasing traffic in winter and the handling of sand for sanding track are discussed.

MANAGEMENT

Increasing Winter Traffic

A 1.—A number of methods for creating traffic during the summer months have been tried with success. What can be done in this same direction during the winter months? What schemes for encouraging travel in winter, such as ice skating, inducing theater traffic, etc., have you tried or have in contemplation?

We have an arrangement with a popular local stock theater, under which we make a combined rate for round trip and entrance to theater, making a minor reduction in our rate, and the theater makes a major reduction in its rate. This applies to the first three performances of the week, namely, Monday night, Tuesday afternoon and Tuesday night. Certain rows of seats are always reserved for the same performance each week and for the same town. For instance, one day recently we had a party of thirty-six booked under this arrangement from a town 33 miles away. To stimulate winter travel we believe in giving reduced rates to lodges and societies to visit each other between neighboring towns.

Theodore Stebbins, Gen. Mgr.
D. S. & U. Elec. Ry., Columbus, O.

We secure considerable theater traffic by making reservation of seats through our agents. Parties desiring to attend any one performance call upon the agent and order seats, giving the location that they would like to have. Reserved seats are then purchased and sent to them through the agent. Keeping the ice on the lakes in parks or rivers clean and advertising good skating produce considerable traffic. Various secret societies visiting each other in different towns are conducive to a good revenue.

A. L. Neereamer, Traffic Mgr.,
Columbus, Delaware & Marion Ry. Co., Columbus, O.

We recently tried a novel scheme for winter excursions. We advertised a free Sunday dinner at Findlay, our largest terminal. Of course, the free dinner was only given with excursion tickets sold at a number of small towns, 20 miles or farther from Findlay. Although the weather was bad, a good carload resulted, and it is probable that we will experiment further with these "Sunday Dinner Excursions." The best restaurants all honored our meal coupons at a reasonable price, as the arrangement induces out-of-town custom for them.

Toledo, Fostoria & Findlay Ry. Co.


GOOD FOR ONE MEAL
Only on Sunday, Oct. 22, 1905
AT
The Dairy Lunch
Meyers Dining Hall
Star Restaurant or
Home Restaurant
FINDLAY, OHIO
T. F. & F. RY. CO.
No. 43

MEAL TICKET USED AS A MEANS FOR CREATING TRAFFIC IN WINTER

We have been quite successful in handling skating carnivals during the cold weather as a method of inducing traffic. In one instance we advertised in local papers and with dodgers for several days calling attention to a skating carnival, offering silver cups as prizes for 100-yard dash, fancy skating and for fancy costumes at night. The attendance was 5000; expenses were $56.43, leaving a balance of $443.57. This we regard as a very profitable method of inducing travel. We also consider the moral effect on the community a very important feature, as our attention to the skating creates a good feeling among our patrons. It is rather difficult to handle a matter of this kind, as no matter how well planned, in this climate the weather may change quickly and cause the programme to be postponed on account of a thaw. The writer had only four days to prepare and get advertisements before the people in this vicinity, but was fortunate enough to have continued cold weather and the arrangements were carried out as scheduled. The writer is convinced that there is quite a field for increasing traffic during the winter season and also in the fall and early spring by the arrangement of golf tournaments, football games and various other forms of amusement. There is also a point in immediately advertising wrecks, fires, etc., that might attract people to ride.

P. Ney Wilson, Supervisor Pub. Serv. Corp.,
South Jersey Div., Camden, N. J.

Net steel signboards, carrying the regular half-sheet bill, are dropped into grooves on front and rear dasher of cars, and this space is given over to advertising the various theaters along the line, also football games, revival meetings, lot sales and, in fact, anything that may cause people to ride. During the summer months these boards have been covered with pictorial posters setting forth the beauties to be seen along the line and the pleasure of a trolley ride to the various points of interest. During the fall, "golden rod" trips to the mountain were advertised by means of bright-colored posters.

J. W. Brown, Supt. Trans.,
West Penn Rys., Connellsville, Pa.

In regard to theater parties, would say that for a party of twenty or more we furnish a special limited car, which stops only at the villages along the line, making no local stops at all. The parties buying return tickets for this car have their seats reserved for them on the return trip.

F. J. Gerdon,
Supt. Trans., Utica & Mohawk Valley Ry.

Our winters are not cold enough to provide much skating. Preparations are being made this year to protect and care for the ice for skating on the lakes at City Park and at one of the other private parks, both of which will be extensively advertised on the cars. There are a large number of theaters open during the entire winter, all of which are very well patronized.

John A. Beeler, V.-Pres. & Gen. Mgr.,
Denver City Tramways.

We have found ice skating a desirable form of amusement for our park during the winter months. The ice is kept smooth by means of a planer drawn by a horse, and one of the summer amusement buildings furnishes a place for skaters to get warm, and where they may be served with light lunch, which is prepared with the aid of electrical cooking utensils. Our rink is part of a pond kept clear for the purpose, about 125 ft. x 225 ft. We found it of advantage to cut a narrow channel completely around the rink except at a few places, to prevent the formation of cracks. We charge a small admission fee and find the sport very popular.

Samuel P. Hunt,
Manchester Tract., Lgt. & P. Co.

The Snow Problem

A2.—What special plans have you made for fighting snow this winter? What particular changes are you making in your snow-fighting methods or apparatus, based upon your previous experience?

At the beginning of winter selections are made from among the most competent motormen living closest to the various car houses, and they are entrusted with the operation of the snow-fighting equipment, which consists of three double-broom sweepers and one double-end rotary plow. This arrangement proved satisfactory last winter, and we see no reasons for making any change. J. W. Brown, Supt. Trans.,
West Penn Rys. Co., Connellsville, Pa.

As respects interference by snow, we find that the interurban cars will keep the track clear with a small amount of shoveling in a few cuts throughout the line, except in city and village streets, and there we have to use city methods of removing snow. Theodore Stebbins, Gen. Mgr.,
D. S. & U. Elec. Ry., Columbus, O.

Not having had our snow-plows out for three years, we feel safe in the apparatus that we have and the methods pursued heretofore. John A. Beeler, V.-Pres. & Gen. Mgr.,
Denver City Tramway.

A3.—Should the responsibility of keeping curves, crossings, switches and special work clear from ice and snow during snow storms be placed in charge of the track department, or should the snow-plow crews attend to this matter?

Our experience last winter indicated that the work of keeping crossings and special work clear from ice and snow can be handled more economically by transportation department than track department. C. A. Coons, Supt. Trans.,
International Ry. Co., Buffalo.

On this road the responsibility of keeping curves, crossing, etc., clear from ice and snow devolves on the track department, but snow-sweeper crews carry salt, shovels and brooms with them and clear switches and special work as they go along, and are thus of great assistance in this work.

J. W. Brown, Supt. Trans.,
West Penn Rys. Co., Connellsville, Pa.

This matter should, in the writer's opinion, be placed in charge of the engineer of maintenance of way.

F. J. Gerdon, Supt. Trans.,
Utica & Mohawk Valley Ry.

The responsibility for keeping curves, switches and crossings clear of ice and snow is handled here by the track department, unless the snow comes with a serious storm. In this event, the transportation and mechanical department unite with the track department, with the one aim of clearing the tracks. Under ordinary conditions, we find it more advantageous to handle this character of work with the track department. The men in this department are available on very short notice, and from the fact that the mechanical and transportation departments do not carry many extra men, it has been found a much more successful proposition to handle track cleaning by men who are available quickly and who are hardened to outside work and capable of standing the exposure. Of course, during serious storms there is very little track work to be done, and this further justifies our conclusions. P. Ney Wilson, Supervisor,
Public Service Corp., South Jersey Div.,
Camden, N. J.

On this road the roadmaster is in charge of cleaning and greasing all the special work and looks after the necessary hand work required to keep crossings, switches and curves free from snow and ice. The transportation department has charge of the sweepers and plows and the cleaning of the straight track and taking care of the snow.

John A. Beeler, V.-Pres. & Gen. Mgr.
Denver City Tramway.

Obtaining Names of Witnesses

B5.—Suggestions are requested on a good and proper way for a conductor to approach passengers to obtain their names and addresses as witnesses in accident cases.

It is rather difficult to give advice on this subject, as the conductor will have to use more or less discretion in handling special cases. First and foremost, of course, the conductor must approach his passengers in a gentlemanly and courteous and proper manner. One of the rules in the standard code of rules as adopted by the New York Street Railway Association and the American Street Railway Association reads as follows: "Treat all passengers with politeness; avoid difficulty, and exercise patience, forebearance and self-control under all conditions. Do not use uncivil, indecent or profane language, even under the greatest provocation." This is a good rule for a conductor to have in mind at all times, and it is applicable when a conductor is endeavoring to obtain the names of witnesses.

The book of rules used by the Philadelphia Rapid Transit Company includes a clause that is in line with the information requested. In the instructions to conductors as to what should be done after an accident, the company tells its men that after rendering assistance to the person injured and obtaining the name and address of the injured party, the next duty is to obtain the full names and addresses of all eye-witnesses. If the witnesses refuse or seem unwilling to give their names, the conductor is instructed to tell them it is the strict rule of the company and if he fails to obtain names of witnesses the company will think that he has not tried to do his duty and he would be subject to discipline. This is an argument that will very frequently induce reluctant witnesses to give their names and addresses. If the witness looks like a business man, it is much easier to merely ask him for his business card, as this avoids the trouble of writing out the name. Some conductors make it a practice to pass out blank slips of paper after an accident, with the request that each passenger write his own name and address thereon.

An enterprising and up-to-date conductor on one of the large systems states that he has saved himself and his passengers considerable trouble by making it a point to know all of his regular riders by name. He keeps a small note-book for this purpose, and whenever he learns the name of a regular rider—either by asking other passengers or in any other way—he puts the name down in his note-book, so that if an accident happens while any of the regular riders are on the car, he is able to turn in the names and addresses of at least those passengers whom he knows by sight.—Editors.

MECHANICAL

Diggers

C4.—Do you know of any satisfactory "home made" or other device to be attached to each car for cleaning the groove of girder rails?

Keeping the grooves of grooved rails clean has always been a vexing question with us. At special work we have switchmen whose duty it is to clean out switches with a broom and grease curves with cheap grade of thick oil.

H. A. Johnson, Ch. Engr.
Public Service Cor., So. Jersey Div.

LINE

Sleet on Wire

E1.—What is the best method of overcoming trouble caused by sleet on the trolley wire?

There is little or no sleet in this country. We have on several occasions used sleet trolley wheels with good results.

John A. Beeler, V.-Pres. & Gen. Mgr.
Denver City Tramway.

We have not found the best method of cleaning sleet from the wire; at least, we have been unable to secure any that has been satisfactory. Our general practice is to install a small steel square in the place of the wheel that will revolve and catch at times, thus scraping sleet from the wire, but this has not been as satisfactory as desired. H. A. Johnson, Ch. Engr.
Public Service Cor., So. Jersey Div.

TRACK

SANDING

F3.—What is the character of sand you use for sanding track?

We have a bright yellow sand on our own right of way which is as good as lake sand for the purpose.
Toledo, Fostoria & Findlay Ry. Co.

We are using for sanding tracks on this division a very clean, sharp white sand taken from neighboring sand pits.
P. Ney Wilson, Supervisor,
Public Service Corp., South Jersey Div.,
Camden, N. J.

Sand which we use for sanding tracks is taken from a bank, screened and dried. E. D. Reed, Engr.
Scranton Ry. Co.

F4.—Is it a good idea to mix salt with the sand in winter?

We do not mix salt with the sand.
John A. Beeler, V.-Pres. & Gen. Mgr.,
Denver City Tramway.

We do not mix salt with the sand in the winter, as it is our opinion that a great deal of motor trouble is obviated by not using salt. E. D. Reed, Engr.,
Scranton Ry. Co.

We do not believe in mixing salt with sand at any season of the year, as the salt attracts the moisture and makes the sand lumpy and reduces its efficiency. We use considerable quantities of salt, but we do not mix it with sand, as the practice has not proved satisfactory with us. P. Ney Wilson, Supervisor,
Public Service Corp., South Jersey Div.,
Camden, N. J.

Think that the effect of salt mixed with sand would be to cause sand to cake with the moisture and prevent free running.
Toledo, Fostoria & Findlay Ry. Co.

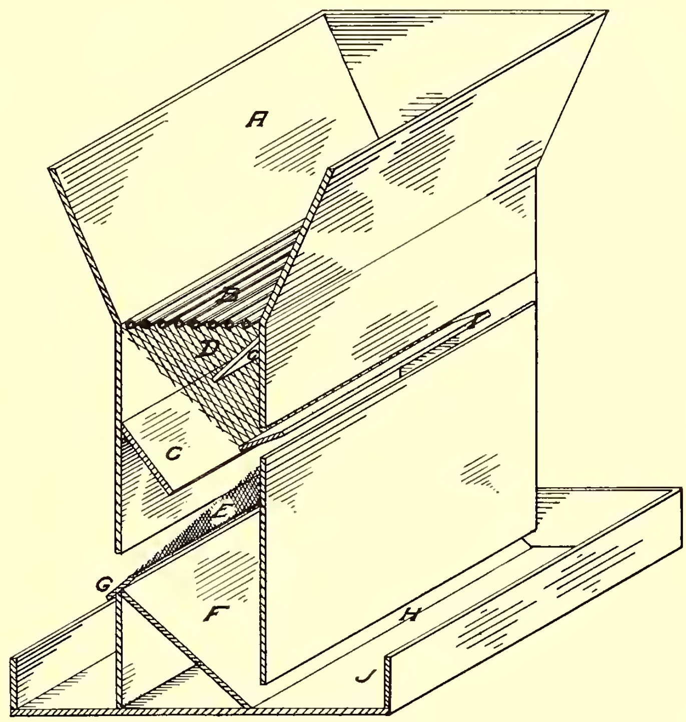
We do not use salt on the track except occasionally on special work to clear the point of a switch or something of a similar nature, where it is absolutely necessary, and then it is applied very sparingly and by hand, and swept out as soon as it has done its work. The roadmaster has charge of the salt, which he gives out to the trackmen as he considers it necessary, and then only in small amounts to each man. It is found that the effect of the electric current in contact with the brine is the formation of a highly corrosive chemical, which strongly attacks the rails, and the effect of which is soon apparent upon the rails wherever salt is used.
John A. Beeler, V.-Pres. & Gen. Mgr.,
Denver City Tramway.

As this is a sandy island and the sand is somewhat mixed with salt from the gulf, we do not have to use sand on our track. It is there already. In operating roads in the North, the only times in which the writer found it was necessary to mix salt with the sand was in grooved rail, and then it was done for the purpose of keeping the groove free from ice, and also where the rail was covered with sleet. If a fine salt is thoroughly and completely mixed with the sand, it will very often hold the sand on the ice, where otherwise the sand by itself would blow off. H. S. Cooper, Gen. Mgr.,
Galveston Elec. Co.

F5.—How do you dry your sand? Please send description of drying apparatus, with sketch or photograph, if possible.

We keep in stock a considerable quantity of sand at all times in one of our old car houses. The sand is spread over the floor immediately after it is delivered and allowed to dry. We use no drying apparatus, as we find the air-drying method entirely satisfactory, sufficient dry sand always being on hand.
P. Ney Wilson, Supervisor,
Public Service Corp., South Jersey Div.,
Camden, N. J.

The sketch herewith shows a sand box that the writer used in the North for a great many years. If properly proportioned as to hopper, screens and the deflecting boards, this will automatically dry and sift any sand—wet or frozen—provided the sand has not any large quantity of clay or other soil in it. The distance between the pipes and the steam coil, the size of the pipes themselves, and also the slope of the screens and the deflecting board, depend very largely upon the kind of sand, that is to say, whether it is an ordinary soil sand, round, fine and dusty, or whether it is a sharp, clean sand. In the latter case, the distance between the pipes can be made larger and the slopes of the boards and screens less than in the case where the sand is a soil sand and liable to compact. The operation



SUGGESTED FORM OF SAND DRYER

of the dryer is as follows: The sand is piled in on top of the steam pipes, and as it dries, falls through. A portion of it falls on the screens *D*, and another portion is deflected by the deflecting board *C* onto the same screen. This screen has a coarse mesh, and is intended to take out only stones, straw, sticks, etc., which will lodge between the edge of it. The screen *D* and the screen *E* can be taken out through the opening *I*. The sand that falls through the screen *D*, or over the edge, falls on the finer screen *E*, and also on the deflecting board *C*, which throws it onto the fine screen *E*, which screen has an opening in the bottom *G*, to allow the small gravel and compact lumps of sand to fall out on the one side, while the fine dry sand, thoroughly sifted and dry, drops on the deflecting board *F*, and comes out of the sand-box *J*, through the opening *H*. In practice, the box is built of rough framing, the only dressed portions being the inside of the hopper and the faces of the deflecting boards, and the size of the screen will vary according to the character of the sand, from a 1-in. to ½-in. mesh for the screen *D*, and from ½-in. to ¼-in. mesh for the screen *E*. The steam coil *B* can be spaced from ½ in.

between pipes to 1 in. between pipes, the sharp, clean sand requiring a less space, while the round sand requires a larger. In practice, it is best to make it a point to put all the sand through a coarse sifter first before putting it into the drying box, as, unless this is done, there will be straw, sticks, stones, roots, etc., that will fill up the space between the pipes and clog the whole box. A box of this character, which the writer made some years ago for a railway in the North, on which a very large amount of sand was used, had a hopper capacity of about ½ cu. yd., and this dryer, fed with live steam from a ⅛-in. pipe, would dry 4 cu. yds. and 5 cu. yds. of sand within 24 hours, and required no attention but the shoveling into the hopper of the wet sand and the shoveling out from the sand-box of the dry sand. At the end of every day's run the flaps on the side, which were left for the purpose, were opened and the screens were brushed off to remove any accumulated rubbish that would tend to clog the openings. It will be understood, the character of the sand used determines the construction of this dryer. The writer has seen it dry fine, round sand which had a large quantity of soil with it, and do this perfectly, day after day, if the screens were brushed off once or twice a day.

H. S. Cooper, Gen. Mgr.,
Galveston Elec. Co.

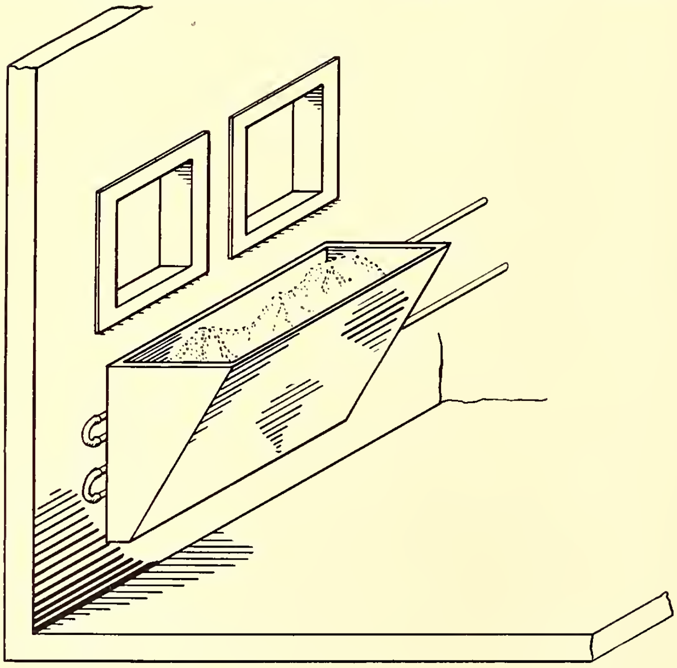
Our sand is hauled in the summer and autumn and dried in the sun; it is then stored in a house built for that purpose, where it keeps dry.

John A. Beeler, V.-Pres. & Gen. Mgr.,
Denver City Tramway.

Our sand is dried at the bank in a Howe sand dryer, made by a local concern.

E. D. Reed, Engr.,
Scranton Ry. Co.

Our dryer is a high bin with a wide top and narrowing at the bottom, which is open. It is set 3 ins. above the floor. The bin is built against the wall of the car house and has a row of steam pipes, as shown in sketch. The green sand is shoveled



SAND DRYER USED BY TOLEDO, FOSTORIA & FINDLAY RAILWAY COMPANY

into the bin from the outside of the car house through windows left for that purpose, and the dry sand runs out at the bottom as fast as it is used.

Toledo, Fostoria & Findlay Ry. Co.

A recent issue of the Sunday Baltimore "American" had as a feature story an illustrated article dealing with the street railway accident fakir and the efforts of the Association of Claim Agents to suppress this type of grafter.

EARNINGS OF OHIO ELECTRIC RAILWAYS

About a year ago a table of statistics was presented of earnings of Ohio properties for the year ending April 30, 1904. It attracted a great deal of attention, as it was the first time that an attempt was made to show the detailed earnings of all the properties in a State, together with the earnings per capita of population tributary to the road and earnings per mile of track. Numerous requests have been received for a similar table for the past year; accordingly it has been brought up to April 30, 1905, the latest date for which such figures are attainable. As before, the earnings per capita for interurban roads are shown, both including and excluding terminal cities of over 75,000 population, as a great many engineers do not consider it fair to take into consideration the population of a large terminal city. As before, also, the census reports of 1900 were used in compiling the estimates of population, and territory within 4 miles on either side of a road was considered tributary to it. With the growth of long-distance interline business, such calculations become more and more misleading, nevertheless they are practically the only basis upon which the probable earnings of a new property can be estimated without careful consideration of local conditions.

A great many interesting figures may be compiled from the table. Out of eighty-five properties in Ohio, only ten showed a decrease in earnings from the previous year. The total gross earnings for the previous period was $21,494,357, while for the latest period the gross is $23,765,007. Freight and express earnings are as yet in their infancy, but fifty-four companies handling these lines earned $564,254 from freight and express, as compared with $476,377 last year. These amounts are not accurate, because in several instances the figures represent the net earnings received from express companies handling the business on the various roads. The Toledo & Western, famous for its freight business, derived about $64,000 from this branch, while the Eastern Ohio Traction Company, another prominent freight-handling road, earned $54,000 gross.

Thirty-five of the purely interurban roads, with more than 20 miles each, earned $7,074,000 on a total mileage of 1804. Deducting lighting earnings, which several of them indicated, this is on a basis of $3,515 gross per mile of track. Including terminal cities of over 75,000, the average per capita for these lines was $1.31, while excluding terminal cities of over 75,000, the average per capita was $5.59. The thirty-five properties in question had a total issued capitalization of $63,581,000 and a bonded indebtedness of $46,122,000, and allowing 55 per cent of the gross for operating expenses, which is about the average for interurbans in this district, the figures indicate that the average interurban is paying its bond interest and is earning a surplus of 1 3-10 per cent for stock. All of these roads showed an increase in earnings the past year, and only ten of them are more than five years old, so that they are not yet fully developed. The average bonded indebtedness per mile of track on these roads was $25,566, while the total debt, bonds and stocks issued, was $60,755 per mile of track. Four roads had no bonded indebtedness. Some of the roads showing the best earnings per mile of track were as follows: Cincinnati Northern (interurban portion), $6,798; Columbus, Buckeye Lake & Newark, $6,366; Northern Ohio Traction Company (interurban portion), $5,852; Cleveland, Painesville & Eastern, $5,237; Cincinnati Interurban Railway, $5,237; Dayton & Troy, $4,585; Toledo, Bowling Green & Southern, $4,502; Stark Electric Railway, $4,465; Lake Shore Electric Railway, $4,377; Columbus, London & Springfield, $3,767; Cleveland & Southwestern Railway, $3,744; Cincinnati, Lawrenceburg & Aurora, $3,739; Dayton & Western, $3,589; Scioto Valley, $3,561; Pennsylvania & Ohio, $3,394.

Some interesting conclusions may also be reached from the figures on city properties. The indications are that lines in

TABLE SHOWING STATISTICS OF OHIO STREET RAILWAY PROPERTIES

Name	Capital Stock (issued)	Bonded Indebtedness. (issued)	City Mileage	Interurban Mileage	Total Mileage	Population, Excluding Terminals over 75,000 (1900)	Population, Including Terminals (1900)	Passenger Earnings Year Ending April 30, 1904	Passenger Earnings Year Ending April 30, 1905	Freight and Express, 1904	Freight and Express, 1905	Other Earnings, 1904	Other Earnings, 1905	Total Earnings Year Ending April 30, 1904	Total Earnings Year Ending April 30, 1905	Earn'gs per Capita Excluding Term.	Earn'gs per Capita Including Term.	Earnings per Mile Track
	$	$						$	$	$	$	$	$	$	$	$	$	$
Ashtabula Rapid Transit Co...	150,000	75,000	5.21	....	5.21	....	12,939	54,322	50,489	....	....	....	....	54,322	50,489	....	3.12	9.691
Camden Inter-State Ry. Co....	1,000,000	1,325,000	....	[1]9.8	9.8	....	[1]14,055	[1]50,972	[1]51,788	....	....	18,572	16,367	[1]69,544	[1]68,155	....	[2]2.98	[2]4,263
Canton-Akron Ry. Co........	1,764,600	1,109,000	18.	36.	54.	....	96,339	361,976	398,320	4,902	20,321	24,527	25,113	392,407	443,754	....	4.71	8,217
Canton-New Phila. Ry. Co....	600,000	565,000	....	22.	22.	....	22,460	57,171	70,697	....	1,081	....	415	57,171	72,194	....	....	3,282
Central Market St. Ry. Co....	1,250,000	500,000	15.6	....	15.6	125,560	125,560	51,512	76,989	....	....	....	32,991	51,512	109,981	....	.87	7,050
Chillicothe El. Lt. & Power Co.	100,000	75,000	4.5	....	4.5	....	18,735	......	19,528	....	....	33,200	34,443	51,934	61,883	....	[2]1.47	[2]6,115
Cincinnati Northern Trac. Co..	3,500,000	3,500,000	5.	67.9	72.9	65,900	477,135	480,058	477,425	[3]19,043	[3]15,896	5,287	15,896	504,387	508,332	7.71	1.13	6,973
Cincin., Hamil'n & Day. Tr. Co	10,000	....	1.41	....	1.41	....	....	2,153	2,040	....	....	....	....	2,153	2,040	....	....	1,461
Cincinnati Interurban Ry Co..	750,000	750,000	....	30.	30.	51,914	377,816	151,688	150,827	....	....	....	2,717	151,688	153,544	2.95	.41	5,118
Cincin., Lawrenceburg & Aur'a	1,000,000	750,000	....	32.	32.	....	....	......	118,836	....	....	....	134	....	118,971	....	....	3,739
Cincin., Newport & Covington.	3,600,000	2,500,000	[1]2.38	....	2.38	....	325,902	411,302	430,520	....	....	18,982	16,726	430,993	447,246	....	1.06	187,921
Cincin., Georget'n & Portsm'th	1,500,000	1,000,000	....	49.	49.	18,817	344,717	76,359	......	55,745	....	10,862	....	142,966	....	....	....	....
Cincinnati Traction Co........	20,036,950	718,000	218.	....	218.	....	325,902	3,600,810	3,785,132	13,506	21,573	27,523	....	3,641,839	3,806,705	....	11.06	17,462
City Railway, Dayton.........	2,600,000	65,000	28.75	....	28.75	....	83,333	403,781	419,936	....	....	20,023	22,238	423,804	442,174	....	5.30	15,379
Cleveland Electric Railway....	23,400,000	8,260,000	236.	....	236.	....	381,768	4,495,702	4,838,085	18,643	28,054	30,598	29,854	4,544,868	4,895,993	....	12.82	20,745
Cleve., Painsv'le & Eastern....	1,606,000	1,402,000	1.	42.8	43.8	33,844	414,608	192,554	204,201	[3]12,577	[3]11,003	4,931	15,203	217,988	230,407	6.08	.55	5,237
Cleve., Painesv'le & Ashtabula.	1,000,000	850,000	....	29.	29.	....	31,369	......	83,809	....	....	....	927	11,149	84,736	....	2.71	2,922
Cleveland & Southwestern.....	4,800,000	2,344,000	....	133.	133.	78,809	460,577	390,610	439,117	[3]26,454	[3]30,693	29,969	27,160	447,082	497,971	6.31	1.08	3,744
Columbus Railway & Light....	5,000,000	2,543,000	94.	12.	106.	2,360	127,926	1,167,725	1,366,361	....	6,209	276,590	344,256	1,444,315	1,716,826	....	[2]10.78	[2]13,021
Cols., Buckeye Lake & Newark	1,500,000	1,243,000	....	39.1	39.1	25,894	151,454	171,554	207,480	11,557	16,032	8,394	25,400	191,504	248,912	9.61	1.64	6,366
Columbus, Delaware & Marion	2,500,000	2,200,000	5.	56.	61.	34,460	160,020	108,086	160,016	7,432	14,367	....	18,303	115,518	192,785	5.59	1.20	3,160
Cols., Grove City & S'western.	250,000	210,000	....	15.	15.	4,500	130,060	38,069	38,882	2,189	3,661	....	....	40,254	42,543	9.45	.32	2,836
Cols., London & Springfield...	2,500,000	1,500,000	....	52.	52.	50,764	176,330	143,425	165,528	13,624	16,833	151	14,053	157,200	195,896	3.85	1.11	3,767
Cols., Newark & Zanesville....	1,250,000	1,250,000	8.	34.	42.	....	....	80,337	167,409	1,563	1,492	4,402	12,526	86,302	180,418	....	....	4,295
Cols., N. Albany & Johnstown.	200,000	150,000	....	8.6	8.6	2,476	128,042	21,276	19,236	3,003	3,754	....	....	24,279	22,990	9.28	.17	2,673
Columbus, Urbana & Western.	....	....	....	7.	7.	....	....	......	8,590	....	30	....	....	1,171	8,620	....	....	1,227
Conneaut & Eastern..........	800,000	329,000	....	30.8	30.8	....	....	......	64,050	....	1,850	....	536	....	66,443	....	....	2,125
Delaware & Magnetic Spring..	....	....	....	11.	11.	....	....	......	3,647	....	307	....	....	....	[6]3,954	....	....	....
Dayton, Covington & Piqua...	1,150,000	480,000	....	33.	33.	26,281	111,614	74,393	73,675	10,021	11,825	....	137	84,388	85,637	3.25	.76	2,595
Dayton & Northern...........	550,000	450,000	....	40.	40.	20,550	105,883	83,320	91,263	11,217	14,391	....	....	94,530	105,653	5.14	.99	2,641
Dayton, Springfield & Urbana.	[4]2,250,000	[4]1,405,000	....	[4]73.	[4]73.	74,112	159,445	[4]214,541	[4]210,349	16,602	14,997	....	5,550	[4]231,143	[4]230,898	[4]3.11	[4]1.44	[4]3,163
Dayton & Troy..............	1,000,000	....	3.	30.	33.	28,950	114,283	125,884	147,867	[3]3,915	[3]6,231	1,161	1,404	140,179	151,312	5.22	1.32	4,585
Dayton & Western............	1,300,000	....	....	40.	40.	34,081	119,414	95,082	128,215	10,380	13,364	833	1,996	106,293	143,576	4.21	1.20	3,589
Dayton & Xenia..............	800,000	800,000	....	53.	53.	21,666	104,999	101,293	96,854	6,413	8,217	3,030	3,959	110,736	109,961	5.08	1.05	2,074
Eastern Ohio Traction Co.....	2,259,000	1,893,000	....	86.	86.	22,748	404,516	144,374	160,944	57,048	54,047	....	6,287	205,597	221,278	9.73	.55	2,507
Elec. Ry. & Power, Tiffin.....	50,000	50,000	7.3	....	7.3	....	10,989	15,285	13,949	....	....	....	....	15,285	13,949	....	1.27	1,910
E. Liverpool and Rock Springs	100,000	100,000	4.5	....	4.5	....	....	......	......	....	....	....	....	....	64,892	....	....	....
Fairfield Trac. Co., Lancaster.	50,000	....	5.2	....	5.2	....	8,991	5,840	5,606	1,936	2,136	....	77	7,864	8,367	....	.93	1,609
Fort Wayne, Van Wert & Lima	....	....	....	35.	35.	....	....	......	......	....	....	....	....	....	[5]5,928	....	....	[7]2,032
Interurban Railway & Terminal	2,500,000	2,500,000	....	101.	101.	45,367	371,269	142,972	172,743	17,148	32,851	732	3,019	160,852	208,614	4 60	.56	2,045
L. Erie, Bowling Green & Nap.	560,000	150,000	....	14.	14.	8,867	8,867	12,141	12,807	....	....	17,005	16,712	29,146	29,519	....	[2]1.44	[2]914
Lake Shore Electric..........	7,496,800	4,897,000	15.	145.	160.	101,806	615,392	585,363	663,354	15,788	23,559	5,028	12,427	610,075	699,340	6.87	1.14	4,377
Lancaster Traction Co........	100,000	....	3.5	....	3.5	....	8,991	21,558	22,596	....	750	2,122	1,970	23,679	25,316	....	2.82	7,233
Lebanon & Franklin..........	200,000	200,000	....	11.	11.	9,242	92,575	......	13,712	....	348	....	102	....	14,248	....	....	1,295
Lima Elec. Ry. & Light Co....	500,000	605,000	19.3	....	19.3	....	21,723	....	......	....	....	....	....	92,502	93,241	....	4.28	4,833
Lorain Street Railway.........	750,000	550,000	....	11.5	11.5	....	26,656	93,285	105,849	564	1,441	2,013	950	95,863	108,240	....	4.06	9,412
Mahoning Valley Railway.....	3,000,000	2,000,000	21.	40.	[1]61.	....	76,993	446,826	444,671	12,541	12,289	1,469	1,872	[1]461,016	[1]458,832	....	[1]5.96	[1]7,522
Mansfield Ry. Light & Power..	1,000,000	728,000	9.	12.	21.	....	25,475	91,038	89,791	1,301	1,694	47,097	56,866	139,437	148,351	....	[2]3.75	[2]4,603
Maumee Valley Ry. & Light..	1,000,000	800,000	....	20..	20.	8,823	140,645	56,736	59,599	4,656	5,925	9,988	10,404	71,381	75,928	[2]7.47	[2].47	[2]3,296
Mt. Vernon Electric Ry.......	75,000	30,000	4.8	....	4.8	....	6,633	9,290	9,496	....	....	1,355	766	10,644	10,262	....	1.55	2,138
No. Ohio Trac. & Light Co...	6,500,000	5,800,000	30.	68.	98.	78,364	460,132	726,444	729,406	[3]23,276	[3]24,876	111,713	119,367	864,314	873,649	[2]9.63	[2]1.64	[2]7,695
Oakwood Street Ry., Dayton..	500,000	....	8.	....	8.	....	85,333	......	......	....	....	....	....	125,494	125,240	....	1.47	15,655
Ohio Central Traction Co.....	1,150,000	400,000	....	30.	30.	....	40,992	......	......	....	....	....	....	85,055	80,098	....	1.95	1,670
Ohio River Elec. Ry. & Power	300,000	315,000	7.	7.	14.	....	19,200	41,688	38,546	4,162	5,107	3,217	3,611	49,067	47,264	....	2.46	3,375
Pennsylvania & Ohio.........	700,000	600,000	....	26.	26.	....	27,228	82,365	......	2,071	....	386	....	84,822	88,255	....	3.24	3,394
Parkersburg, Marietta & Int..	440,000	150,000	10.	17.5	27.5	....	....	171,896	183,504	....	....	55,465	17,993	227,081	201,498	....	....	[2]6,672
Peoples Ry. Co., Dayton......	1,100,000	500,000	31.	....	31.	....	85,333	272,895	284,100	....	250	25,263	24,041	298,158	308,392	....	3.61	9,948
Portsmouth Ry. & Light Co...	125,000	83,000	4.	4.	8.	....	19,670	49,733	67,614	....	....	32,143	30,262	81,776	97,876	....	[2]3.44	[2]8,452
Price Hill Inclined Ry........	75,000	....	....	....	....	....	....	......	11,047	....	18,285	....	....	26,323	29,332	....	....	....
Salem Electric Railway........	100,000	50,000	3.2	....	3.2	....	5,780	9,279	......	18	....	....	....	9,297	7,781	....	1.35	2,431
Sharon & New Castle.........	380,000	....	....	[1]4.4	[1]4.4	....	....	[1]10,090	9,301	254	394	....	....	[1]10,335	[1]9,695	....	....	[2]2,203
Springfield Railway Co........	1,000,000	600,000	28.6	....	28.6	....	38,253	202,280	212,002	....	....	827	837	203,107	212,839	....	5.56	7,441
Springfield & Xenia...........	500,000	500,000	....	20.	20.	....	53,653	53,360	54,245	....	1,677	2,435	822	55,798	56,744	....	1.06	2,837
Stark Electric Railway........	1,000,000	1,000,000	6.	26.	32.	....	50,241	105,424	140,064	....	1,803	1,395	1,017	106,819	142,883	....	2.84	4,465
Steubenville, Mingoe & Ohio..	150,000	150,000	....	9.	9.	....	19,503	54,984	55,263	2,974	3,029	....	....	57,958	58,291	....	2.99	6,477
Steubenville & Pleasant Heights	....	....	2.2	....	2.2	....	14,349	8,212	......	....	....	....	....	8,212	8,422	....	.60	3,827
Steubenville Trac. & Light Co	1,000,000	700,000	5.	12.5	17.5	....	21,975	78,562	82,327	1,436	2,305	....	1,791	[2]79,998	[2]86,424	....	[2]3.97	4,938
Scioto Valley Railway.........	1,025,000	....	....	47.	47.	31,944	157,504	......	[8]119,787	....	....	....	6,479	....	[8]126,269	[7]5.30	[7]1.08	[7]3,561
Springfield & South Charleston	....	....	....	10.	10.	....	....	......	......	....	....	....	....	....	[11]277	....	....	....
Springfield, Troy & Piqua.....	70,000	....	....	29.	29.	....	....	......	[8]37,012	. ..	1,066	....	16,124	....	[8]54,203	....	....	[2][7]1,760
Tiffin, Fostoria & Eastern.....	175,000	175,000	....	17.	17.	....	23,619	45,690	46,257	2,647	3,108	751	760	49,087	50,115	....	2.12	2,984
Toledo, Bowling Green & So...	1,500,000	1,223,000	5.	46.	51.	46,901	178,723	189,104	215,718	2,806	7.639	61,854	59,090	253,762	282,447	[2]4.94	[2]1.30	[2]4,502
Toledo, Fostoria & Findlay....	750,000	750,000	....	16.8	16.8	....	30,922	48,147	45,609	2,806	3,033	2,147	1,196	53,428	49,832	....	1.61	2,966
Toledo & Indiana.............	2,500,000	1,500,000	....	30.	30.	11,895	143,717	56,237	68,279	8,935	10,472	....	45	65,168	78,796	6.62	.55	2,627
Toledo Railway & Light Co...	12,000,000	10,020,000	110.	....	110.	....	131,822	1,175,239	1,215,147	....	3,605	477,882	530,888	1,653,220	1,749,640	....	[2]9.82	[2]11,772
Toledo & Western............	1,600,000	1,500,000	....	78.5	78.5	34,820	166,642	123,637	135,735	48,303	63,337	4,826	5,333	175,767	204,406	5.87	1.23	2,604
Tuscarawas Traction Co.......	250,000	100,000	....	13.	13.	....	25,797	......	43,542	....	2,476	....	732	60,666	46,752	....	1.81	3,598
Toledo, Port Clinton & Lakes'e	1,000,000	....	....	25.6	25.6	....	....	......	......	....	....	....	....	....	[9]22,198	....	....	[7]1,732
United Power Co., E. Liverpool	900,000	600,000	8.	7.	15.	....	25,315	147,694	148,449	....	....	34,816	35,427	182,510	183,875	....	5.86	[2]9,896
Victory Park Railway.........	5,000	....	1.5	....	1.5	....	....	......	......	....	....	....	....	7,438	s5,716	....	....	3,811
Western Ohio Railway........	3,000,000	2,266,000	....	78.5	78.5	....	71,819	195,003	224,713	9,717	[3]1,618	1,086	4,426	204,806	230,758	....	[2]3.15	[2]2,883
Wheeling Traction Co.........	1,836,700	2,312,000	7.28	15.5	[1]22.78	....	....	......	263,758	....	5,269	....	....	[1]195,465	[1]209,841	....	....	[1]9,211
Youngstown & Sharon........	712,500	600,000	....	13.5	[1]13.5	....	60,401	101,087	93,901	7,204	6,996	....	....	[12]108,292	[12]100,897	....	[2]1.67	[12]7,468
Youngstown Park & Falls.....	200,000	200,000	6.5	....	6.5	....	44,885	......	......	....	....	....	....	65,553	63,908	....	1.42	9,832
Youngstown & Southern.......	1,234,000	539,000	....	15.5	15.5	....	....	......	[10]7,283	....	[10]697	....	....	....	[10]7,980	....	....	[7]1,374
Zanesville Ry. & Light Co.....	1,000,000	750,000	14.	....	14.	....	23,538	......	113,921	....	....	....	60,289	98,621	174,210	....	[2]5.02	[2]8,444
Totals.....................	154,135,950	86,734,000	1022	2129	3151	....	....	......	......	476,377	564,254	....	....	21,494,357	23,765,007	....	....	....

[1] Ohio portion only. [2] Lighting and power earnings not included. [3] Net from operating express company. [4] Operated lines included. [5] Earnings for first month in operation. [6] Earnings for 10 months. [7] Based on estimated earnings for year. [8] Earnings for first 9 months. [9] Earnings for first 6 months. [10] Earnings for first 5 months. [11] Earnings for 10 days. s Operated only in summer.

small towns are not very profitable; the earnings, both per mile of track and per capita, increase as the towns grow larger. Four roads in towns under 10,000 population earned an average of $2,047 per mile of track and $1.27 per capita. Seven city properties in towns ranging from 10,000 to 25,000 population earned $6,737 per mile of track and $3.58 per capita. Three roads in cities ranging from 25,000 to 75,000 averaged $9,063 per mile of track and $5.71 per capita. Seven systems in cities from 100,000 to 400,000 population averaged $14,855 per mile of track and $12.50 per capita, not including lighting earnings in any case.

THE INSTRUCTION OF MOTORMEN IN MONTREAL

MONTREAL STREET RAILWAY COMPANY

Montreal, Can., Jan. 15, 1906.

EDITORS STREET RAILWAY JOURNAL:

The article in the last issue of the STREET RAILWAY JOURNAL describing the motormen's school at Montreal, emphasizes the importance of properly training employees.

Since the adoption of electricity as a motive power both for city and interurban railways, there seems to be a vast difference of opinion among the officials of the various roads as to just what kind of men should be employed as motormen, and how they should be trained and instructed so as to be able to run a car at a fair rate of speed through the most congested streets on which cars are operated at present, without causing loss of life or damage to rigs or other cars.

Several companies believe it unwise to instruct a motorman so that he may become familiar with the mechanical and electrical equipment, as they presume he might be tempted to tamper with the apparatus and cause damage. Other companies have established training schools and have a chief instructor in charge, who thoroughly explains the electrical and mechanical equipment in all its details, so that the new men are not only acceptable motormen, but fairly good electricians who can do slight repairing in case of emergency so as to enable if necessary the conveying of a car to the house without the aid of the car following, and the consequent loss of mileage of two cars and a longer gap in service. These companies further claim that when thoroughly instructed, motormen can be held responsible for the proper operating of their cars and, if necessary, be disciplined accordingly. We all will agree there can be very costly damage caused to the mechanical and electrical equipment by the improper operating of a car through lack of knowledge. Why should there be so much difference of opinion? Does a company expect that its cars will be operated in an economical manner without thoroughly explaining the mechanical and electrical equipment of the car to the new men, and how can it hold a motorman responsible for damage which he may cause to the equipment through want of knowledge? Again, how can a company in fairness discipline such an employee, and there must be a certain amount of discipline, for not properly protecting the company's property if the employee knows nothing about it?

Another important point is this. Cars very frequently lose trips by pulling into shop for some slight cause, which could have been repaired on the road by the motorman in a few seconds had he been so instructed. In my opinion, a motorman cannot be made too familiar with the mechanical and electrical equipment in his charge, and no doubt better results would be obtained, as no excuse can then be given for damage caused to a car.

With regard to tampering with the equipment and causing damage, proof can be given that in every case such damage is always caused by men who have not been thoroughly instructed about the mechanical and electrical equipment of a car, and they experiment in order to satisfy their own curiosity.

J. CALLAGHAN,
Inspector and Chief Instructor.

REPORT OF THE NEW YORK STATE RAILROAD COMMISSIONERS

The report of the Board of Railroad Commissioners of New York State has just been published. It shows that the total gross earnings from operation of the street surface, elevated and subway railroads were $70,730,085.66, which is an increase of $4,577,655.07 over 1904. In these and the following figures, the statistics of the following electric roads are not included, as they operate under steam railroad charters: Albany & Hudson; Fonda, Johnstown & Gloversville; Long Island Railroad, and Rochester, Charlotte & Manitou. These companies had a total of 207 miles of track equipped with electric power on June 30, 1905.

The operating expenses of the street surface, elevated and subway roads of the State, with these exceptions, were $40,195,443.54, which is an increase of $2,951,769.72 over 1904. The figures for 1904, of course, do not include the subway. The percentage of dividends to capital stock of said companies is 4.83; in 1904 it was 4.09.

In referring to New York City, the report says that the passengers carried on the street surface railroads in the boroughs of Manhattan and the Bronx, New York City (including "transfers"), was 601,761,867, a decrease of 16,998,191 compared with 1904. The number of transfers was 188,738,309. The number of transfers in these boroughs decreased 5,410,263. The average number of passengers carried on street surface railroads in the boroughs of Manhattan and the Bronx per day (365 days) was 1,648,663 during 1905. These figures as to Manhattan and the Bronx include some passengers carried in Westchester County. The number of passengers carried in the borough of Brooklyn (including transfers and including those carried on the elevated railroads) was 427,895,530. The number of transfers was 76,482,207. The average number carried per day (365 days) in the borough of Brooklyn was 1,172,317. These include some carried in the borough of Queens by the Brooklyn roads.

Following will be found tables giving percentages of operating expenses for all roads:

PERCENTAGES OF OPERATING EXPENSES TO GROSS EARNINGS

	1904	1905
Maintenance of way and structures	4.42	4.93
Maintenance of equipment	6.91	7.95
Operation of power plant	9.15	9.50
Operation of cars	26.42	25.05
General expenses	9.40	9.40
	56.30	56.83

PERCENTAGES OF SUBDIVISIONS OF OPERATING EXPENSES

	1904	1905
Maintenance of way and structures	7.87	8.70
Maintenance of equipment	12.28	13.99
Operation of power plant	16.23	16.70
Operation of cars	46.94	44.07
General expenses	16.68	16.54
	100.	100.

PERCENTAGE OF OPERATING EXPENSES TO GROSS EARNINGS FROM OPERATION FOR TEN YEARS

1896	61.96
1897	60.57
1898	60.07
1899	59.62
1900*	58.78
1901*	56.89
1902*	58.91
1903*	57.70
1904†	56.30
1905†	56.83

* Including elevated roads in Brooklyn.
† Including elevated roads in Brooklyn and Manhattan and (in 1905) the subway in Manhattan.

The following table gives statistics relative to the operation of some of the more important companies:

Street Surface Railway (some principal companies) Receipts and Expenditures per passenger and cost of operation per car mile for year ending June 30, 1905.

NAME OF ROAD.	Number of passengers carried, including transfers.	Total car mileage.	*Based upon Gross Earnings from Operation and Operating Expenses.		*Based upon Receipts from all sources and total Expenditures, Including Fixed Charges.		Per Car Mile.		
			Average earnings per passenger. Cents.	Average cost of operation per passenger. Cents.	Average receipts per passenger. Cents.	Average expenses per passenger. Cents.	*Gross earnings. Cents.	*Operating expenses. Cents.	*Total expenses including fixed charges. Cents.
Albany & Hudson	1,354,169	704,050	14.18	11.28	17.93	17.61	26.57	22.62	33.87
Auburn & Syracuse	3,482,504	1,066,330	7.71	4.66	7.74	6.74	25.18	15.47	22.02
Binghamton	6,479,427	1,285,067	3.99	2.11	4.03	3.42	20.14	10.65	17.23
Brooklyn Heights†	286,392,708	44,567,665	4.11	2.42	4.19	3.91	26.40	15.57	25.11
Coney Island & Brooklyn	38,842,527	6,629,842	5.18	2.99	4.13	3.74	24.13	17.53	21.79
Crosstown Street (Buffalo)	15,707,279	2,410,038	3.38	1.81	3.41	2.92	22.03	11.78	19.06
Forty-second St., M. & St. N. Ave. (N. Y. City)‡	26,125,979	3,339,349	3.02	2.51	3.36	4.01	23.61	19.64	31.06
Geneva, Waterloo, Seneca Falls & C.L.	1,785,940	485,912	4.65	2.95	4.84	4.11	17.08	10.84	15.11
Hudson Valley	5,955,891	1,927,473	8.38	5.62	8.01	9.84	25.89	17.36	30.40
International (Buffalo)	89,785,647	14,682,630	4.12	2.24	4.23	3.21	25.16	13.71	20.16
Jamestown	4,015,872	870,554	3.78	2.39	3.82	3.31	17.46	11.05	15.28
Kingston Consolidated	2,537,426	535,527	4,87	2.89	4.88	4.47	23.15	13.70	21.17
Nassau Electric	68,231,120	10,467,139	4.09	2.52	4.23	3.81	26.72	16.33	24.85
New York City§	476,929,345	50,293,559	3.50	1.95	3.73	4.29	33.21	18.52	40.71
New York & Long Island	1,534,106	480,273	6.78	4.49	6.83	4.96	21.66	14.37	15.86
New York & Queens Co	18,319,217	3,263,185	4.02	2.43	4.07	3.53	22.54	13.64	19.82
Rochester	45,276,270	6,991,775	3.81	2.14	3.89	3.03	24.68	13.88	19.64
Rochester & Eastern	1,030,414	762,586	20.64	15.08	21.48	23.09	27.89	20.39	31.21
Schenectady	11,064,269	3,286,537	6.32	4.48	6.57	6.02	21.29	15.09	20.29
Syracuse & Suburban	1,771,075	453,820	5.20	2.95	5.23	4.82	20.29	11.51	18.82
Syracuse Rapid Transit	23,268,828	4,011,635	2.82	2.21	3.84	3.26	22.15	12.82	18.91
United Traction (Albany and Troy)	34,206,367	8,035,896	5.01	3.19	5.06	4.21	21.34	13.61	17.81
Utica & Mohawk Valley	14,649,423	3,389,069	5.43	3.55	5.45	4.77	23.46	15.37	20.60
Union (N. Y. City)	44,929,958	6,197,621	3.08	2.17	3.12	2.76	22.36	15.75	19.98

*Includes earnings and expenses of freight, express, mail and all other business. †Includes all lines operated by Brooklyn Heights not making separate reports. ‡Includes portion operated by horses. §Includes all lines operated by New York City not making separate reports and also includes lines operated by horses.

The following table shows increases in the street surface, elevated and subway railway mileage in the State during the year:

INCREASES

Binghamton	1.000
Brooklyn City	.208
Brooklyn, Queens County & Suburban	1.969
Chautauqua Traction	14.648
City of New York, Williamsburg Bridge	1.623
Coney Island & Gravesend	.040
Hamburg	2.750
Interborough, lessee of subway in New York City	16.960
International, Buffalo	.311
Nassau Electric, Brooklyn	.930
New York & Long Island Electric	5.843
Ocean Electric	.450
Olean	2.950
Oneonta, Cooperstown & Richfield Springs	12.170
Rockaway Electric	.180
Schenectady	1.690
Syracuse Rapid Transit	3.570
Tarrytown, White Plains & Mamaroneck	1.530
Union of New York City	.385
Westchester Electric	2.082
	71.289

The average number of persons, including officials, employed during the year ending June 30, 1905, on all the street railroads of the State (including street surface electric and horse railroads, the Brooklyn Union Elevated Railroad, the Manhattan Elevated Railway and the subway) was 41,699; in 1904, 38,427, not including the subway. The aggregate amount of salaries and wages paid them during the year was $27,651,598.86; in 1904, $23,721,992.80. The percentage of gross earnings from operation paid in salaries and wages in 1905 was 39.09. The same companies owned and operated on June 30, 1905, 6737 electric motor or cable box cars; 3886 electric motor or cable open cars; 557 electric motor combination box and open cars; 31 electric motor combination passenger and baggage cars; 13 electric motor mail cars; 531 electric motor express, freight and other cars; 402 electric motor snow plows, sweepers and sprinklers; the total being 12,157; in 1904, the total was 11,667; 15,945 fenders were reported in 1905 as in use on cars. Some of these fenders are transferred from one end of the car to the other at terminals, and some of the devices reported as fenders are wheel guards; 3,350 other cars (being cars operated by horses, and box, open, freight, express, service cars and snow plows not equipped with motors) were also owned and operated on June 30, 1905.

The number of tons of freight reported as carried on the street surface railroads of the State during the year ending June 30, 1905, was 829,291; the number carried during each of the years beginning with the year 1899 was as follows:

1899	129,040
1900	153,343
1901	287,311
1902	394,641
1903	516,460
1904	633,674
1905	829,291

On some of the roads separate express companies operate, and in some of these cases the amount carried is not reported.

The general recommendations as to the operation of street surface railroads made in the previous reports of the board are renewed, as the board says that these recommendations have been quite generally adopted.

The acquisition of electric railroads by interests connected with steam railroads, first noted last year, has continued during the year, the electric railroads acquired being city as well as interurban roads.

REPORT OF THE MASSACHUSETTS RAILROAD COMMISSIONERS

The report of the Massachusetts Railroad Commissioners for the year ending Sept. 30, 1905, was made public Jan. 15. The commissioners report that returns have been received from ninety-eight street railway companies. During the year five new companies were organized under the general law and added to the list, namely, the Haverhill & Boxford, the Maplewood & Danvers, the Nahant & Lynn, the Plymouth County and the Western Massachusetts. Four other companies were organized during the year under the general law and added to the list, being purchasers of railways sold at receivers' sale: the Dedham & Franklin, purchaser of the Norfolk Western; the Lowell & Woburn, purchaser of the Lowell & Boston; the Taunton & Buzzards Bay, purchaser of the Middleborough, Wareham & Buzzards Bay; and the Taunton & Pawtucket, purchaser of the Bristol County.

The Massachusetts companies now own 2,219.792 miles of street railway line, 405.442 miles of second main track and 151.474 miles of side-track, making a total length of track owned 2,776.708 miles. This statement excludes the track in the subway. All the track owned is surface street railway track with the exception of 6.644 miles of elevated line and 6.468 miles of elevated second track. Of the sidings, all are surface track with the exception of 2.903 miles of elevated track. All of the elevated track is confined to Boston.

The Old Colony leases and operates the Newport & Fall River, having a mileage of main and second track of 19.268 miles located in Rhode Island; and the Boston & Northern leases and operates the Nashua, having a mileage of main and second track of 14.899 miles located in New Hampshire. Accordingly, 52.933 miles of main and second track are operated outside the State.

CAPITAL STOCK AND DIVIDENDS

The aggregate capital stock of the ninety-two companies, Sept. 30, was $70,326,984.78, a net increase of $1,784,947.28 over the preceding year.

The total amount of dividends declared the last year was $3,174,505.24, a decrease of $39,991 from the preceding year. Thirty-five out of the ninety-eight companies paid dividends ranging from 2 per cent to 10 per cent, and sixty-three companies declared or paid no dividends.

One company paid 10 per cent; five companies paid 8 per cent; one paid 8 per cent on preferred and 7 per cent on common; one paid 7.22 per cent; one paid 7.20 per cent; one paid 7 per cent; eleven paid 6 per cent; one paid 5.5 per cent; seven paid 5 per cent; one paid 4 per cent; one paid 3.75 per cent; one paid 3.50 per cent; one paid 3 per cent; and two paid 2 per cent.

COST AND CAPITAL INVESTMENT PER MILE

The average cost of the street railways of the State, per mile of main track (including the cost but not the length of side-track), as it stood on the books of the companies Sept. 30, was $27,875.95 for construction, $10,111.59 for equipment, and $13,321.48 for lands, buildings (including power plants) and other permanent property, making a total average cost of $51,309.02 per mile of main track.

INCOME AND EXPENDITURES

The total income of the companies from all sources, for the year ending Sept. 30, 1905, was $28,638,251.58, and the total expenditures (including dividends) were $28,256,066.46, making a net surplus of $382,185.12 to be added to the surplus of previous years.

The gross earnings and expenses of operation the last year are classified and compared with those of the previous year, in the following table:

GROSS EARNINGS AND EXPENSES OF OPERATION, 1904 AND 1905

EARNINGS AND EXPENSES.	1904.	1905.	Increase.
Revenue from passengers,..	$25,619,597	$26,384,587	$764,990
from mails and merchandise, ...	93,344	105,625	12,281
from tolls and advertising, etc.,...	494,306	551,079	56,773
Gross earnings from operation..................	$26,207,247	$27,041,291	$834,044
Operating expenses,........	18,397,291	18,269,259	128,032*
Net earnings from operation,.	$7,809,956	$8,772,032	$962,076

* Decrease.

VOLUME OF TRAFFIC

The total number of passengers carried during the last year on the railways of the ninety-eight companies making reports to the board was 532,731,017, an increase of 12,674,506 passengers over the previous year.

The total number of miles run by street cars was 109,258,739, an increase of 1,361,283 miles over the previous year.

The following tables give for each of the last ten years the average gross earnings, operating expenses and net earnings from operation per car-mile run and per passenger carried, thus showing more in detail the changes from year to year in the earnings, cost and net results of operation:

GROSS AND NET EARNINGS FROM OPERATION PER MILE OF MAIN TRACK OWNED, 1896-1905

YEARS.	Average per Mile of Track Owned.		
	Gross Earnings.	Expenses of Operation.	Net Earnings.
1896......................	$11,627	$8,274	$3,353
1897......................	11,187	7,713	3,474
1898......................	10,098	7,589	3,409
1899......................	10,459	7,132	3,327
1900......................	10,452	6,878	3,574
1901......................	9,998	6,690	3,308
1902......................	9,609	6,510	3,099
1903......................	10,124	6,944	3,180
1904......................	10,178	7,145	3,033
1905......................	10,300	6,959	3,341

GROSS AND NET EARNINGS FROM OPERATION PER CAR-MILE RUN AND PER PASSENGER CARRIED, 1896-1905

YEARS	Average per Car Mile.			Average per Passenger.		
	Gross Earnings.	Expenses of Operation.	Net Earnings.	Gross Earnings.	Expenses of Operation.	Net Earnings
1896..	27.69	19.70	7.99	5.08	3.61	1.47
1897..	25.68	17.71	7.97	5.12	3.53	1.59
1898..	24.80	17.11	7.69	5.11	3.52	1.59
1899..	24.74	16.87	7.87	5.09	3.47	1.62
1900..	24.46	16.10	8.36	5.06	3.33	1.73
1901..	23.40	15.66	7.74	5.02	3.36	1.66
1902..	23.42	15.87	7.55	5.05	3.42	1.63
1903..	23.76	16.30	7.46	5.06	3.47	1.59
1904..	24.29	17.05	7.24	5.04	3.54	1.50
1905..	24.75	16.72	8.03	5.08	3.43	1.65

GENERAL DISCUSSION

The commendable features in the management of the Boston Elevated Railway would undoubtedly receive favorable criticism that is now withheld were it not for the crowding of stations and of cars at certain hours in the morning and evening. While the company during the year has brought into use more cars and trains, added to its force of employees, made changes at stations and introduced the change to side doors at the ends of cars, the public must await the completion of the Washington Street subway, now being constructed in a manner that challenges the admiration of those interested in such work; the building of the extension to Forest Hills, with accompanying changes in stations, and the abolition of the Dudley Street railroad crossing, for which the board has recently approved plans, before the running of longer trains and a greater freedom in distribution of traffic will effectually relieve the still present evil of overcrowding.

In the last report attention was called to the unsatisfactory showing by street railway companies in their annual returns. The returns of the year that has just closed exhibit some improvement, but the fact remains that unwise promotion, increase in cost of operation and the sins of past managements in paying dividends with earnings that ought to have been used in renewal of properties, make the task of placing many of these railways upon a prosperous footing a difficult and tedious one.

There have been here and there increases in fares. Some of these, when reviewed by the board, upon complaint of communities affected, have been approved, some approved in part, others disapproved. As predicted, increase in cost of travel has resulted not infrequently in such decrease of patronage as to make the change unprofitable as well as unpopular. Upon the whole, however, there seems to be promise that companies under wise management will in time realize a reasonable return upon investment. The present heavy burden of reconstruction will doubtless afford the foundation for future profitable operation and tend to create a permanent dividend-paying basis. A management that recognizes this should be supported by stockholders for selfish reasons.

The practice of locking from the outside the door leading from the body into the front vestibule of street cars was recently criticized in an order of the board, in which it was held that companies in permitting this were adding a new peril to travel in case of mishap to the motorman or in case of collisions, in either of which it might be of great importance to reach the front vestibule from within the car.

This practice had been adopted by companies in the effort to prevent passengers from occupying the front vestibule, where they are likely to interfere with or discommode the motorman in his work, and so increase the liability of accident. The record furnishes abundant evidence that the crowding of vestibules has often been a cause of accident, and the taking of measures to prevent it is certainly to be commended.

To meet the objection to the present method of locking doors, it is proposed to adopt some device which will enable the conductor as well as the motorman to open them. In the opinion of the commission, legislation which would make the violation of a proper rule for the protection of motormen a criminal offense, would be desirable in the interest of safety.

The record of disaster upon steam railroads and electric railways had already greatly disturbed the public mind throughout the country, when several catastrophies within Massachusetts followed in rapid succession. The investigation of the board is not to fix either civil or criminal responsibility, but wholly for the purpose of suggesting measures to lessen the dangers of the future.

The first of a group of recent accidents occurred upon the Worcester & Southbridge Street Railway. An attempt, as the result of an understanding between the despatcher and the motorman, to make connection between a special car sent out late at night and a regular car upon another railway, was the underlying cause of reckless speed in approaching a sharp curve upon a down grade, which resulted in derailment of the car and death to two and injury to other passengers. The carelessness of employees and the failure of the management to effectually establish and enforce proper rules contributed to this accident. The board makes the general recommendation that in approaching sharp curves at the foot of heavy grades, street cars should always come to an absolute stop, at a point indicated by the maintenance of a stop sign.

Another accident of most unusual character took place upon the Boston Elevated Railway. As a train of four cars reached a cross-over between the drawbridge and City Square station in Charlestown, the forward truck of the rear car was derailed, the wheels being thrown to the right of the running rails. With the truck in this condition the train continued to move forward until it reached the inside steel guard rail at the curve near the station. At this point the derailed truck was thrown to the left, where it remained until the train was brought to a stop. A subsequent examination of the rear truck of the third car showed a broken pinion on the armature shaft of one of the motors and one tooth broken from the axle gear. As a result of these breaks, which arose from conditions that could not have been foreseen, the gears became wedged, causing the wheels to slide, and in so doing to make a flange on the outside of the tread of the wheel. This flange undoubtedly opened the switch enough to cause the forward truck of the rear car to leave the rail. The motorman in charge of the train, noticing trouble at Scollay Square, sent word for an inspector, and he was actually engaged in looking up the trouble, having reached the rear end of the second car when the derailment took place. One prominent factor in keeping the train upon the structure and preventing the loss of life that would have followed had it been thrown to the street below is found, we believe, in the type of construction. If there had been here the solid floor often advocated in the interest of quieter operation, it is altogether likely that in rounding the curve the cars would have been thrown into the street. Tied together as it was, the existing structure offered a resistance which a railway with solid flooring would not have given.

In approving a construction similar to this for the extension of the elevated railway to Forest Hills, against the objection of those who urged a solid floor, the action of the board was based upon the belief that in the climate of Boston this form of structure is safest. Its strength as proved in this test adds another to the reasons which seem to justify the selection.

ANNUAL MEETING AND BANQUET OF THE INDIANA ELECTRIC RAILWAY ASSOCIATION

At the January meeting of the Indiana Electric Railway Association the decision was made to ally this association with that of the Ohio Interurban Association, the combined association to be called the Central Electric Railway Association. The meeting just held will consequently be the last in the history of the Indiana Electric Railway Association. Negotiations for the amalgamation of the two societies were carried on in committee meetings and interfered very little with the regular programme. The meeting was the annual one, and in addition to the regular afternoon session, it included a 6 o'clock dinner in the ladies' dining room of the Claypool Hotel.

The afternoon session, which was held in the palm room of the hotel, was called to order by President Henry at 2:15 o'clock, with F. D. Norveil acting as secretary in the absence of Secretary Paul H. White. After the minutes of the previous meeting had been read and approved, President Henry suggested that as the election of officers was to be held at the close of the meeting that a committee on nominations be appointed. The committee as appointed later by President Henry consisted of A. A. Anderson, C. D. Emmons and H. A. Nicholl.

As chairman of the committee appointed at the December meeting to confer with a similar committee from the Ohio Association regarding a union of the two associations, Arthur W. Brady, president of the Indiana Union Traction Company, reported that the two committees had met the previous evening and that the Indiana committee was ready to report in favor of the proposed alliance. Some of the reasons for the decision, as stated by Mr. Brady, were that the maintenance of a permanent secretary, which would be possible by the union of the two associations, would be invaluable; information could be compiled, subject to the call of any member; facilities for advertising would exist, and many matters now handled in a disjointed manner could be taken care of systematically. As against these advantages, however, he pointed out some drawbacks to an alliance. The meeting place could not be as convenient a point to all, and wherever it was it would be difficult of access to some. But the objections did not counterbalance the advantages. Mr. Brady considered that the meetings could be held less frequently, and that members would then make a little more effort to attend them. Moreover, attending a meeting away from home would have more of an educational value.

At the conference of the committees, the question of a name for the combined association arose, and the name Central Electric Railway Association was proposed. As to the method of governing, the suggestion was made that there be two vice-presidents, one from Indiana and one from Ohio. As a vice-president is usually selected as president, this arrangement would cause the presidency to alternate between the two States. An executive board consisting of five members from each State was suggested. It appeared also that it would not be best to confine the association to Indiana or Ohio, as in the future it might be found advisable to include adjacent States.

Mr. Brady stated further that the Ohio Association had given its committee power to act, and that if the Indiana Association would give its committee the same power it would be possible to take action at once.

The report of the committee was adopted, and a motion was carried that a committee of five, with power to act, be appointed. The same committee that had previously carried on the negotiations with the Ohio committee was reappointed. This consists of C. L. Henry, president and general manager of the Indianapolis & Cincinnati Traction Company; C. C. Reynolds, general manager of the Indianapolis & Northwestern Traction Company; C. D. Emmons, general manager of the Fort Wayne & Wabash Valley Traction Company; Arthur W. Brady, president of the Indiana Union Traction Company, and W. G. Irwin, vice-president and general manager of the Indianapolis, Columbus & Southern Traction Company.

As there was no further miscellaneous business, the regular programme was taken up by Charles C. Mordock, superintendent of power of the Terre Haute Traction & Light Company, who presented a paper entitled "Steam Turbines." The paper described the turbine plant of the Terre Haute Traction & Light Company. The original plant, consisting of one 500-kw Curtis turbine, was described at some length in the Street Railway Journal for Feb. 4, 1905. Since that time, however, a 1500-kw unit has been installed. A short time ago some tests were made on the smaller turbine by students of Rose Polytechnic Institute. These tests did not show as good results as it is believed the turbine is capable of giving, due to the fact that at the time of the test the condenser was in a leaking condition.

G. H. Kelsay, superintendent of power of the Indiana Union Traction Company, discussed the paper read by Mr. Mordock, and made some supplementary remarks concerning turbines.

Regarding the points of superiority of the turbine over the reciprocating engine, Mr. Kelsay mentioned that the turbine has a high steam economy over a widely varying range of loads, and hence was desirable for the rapidly fluctuating loads encountered on street railway systems. The uniform angular velocity of the turbine was also of great advantage when alternators were to be driven in parallel. The simplicity of operation, the low expense of maintenance, the fact that the steam economy is not affected by long service, and the ability to keep the condensed water free from oil and return it to the boiler were also strong points in favor of turbines.

Mr. Kelsay gave some comparative results of steam consumption of reciprocating engines and turbines. The best results of turbine tests published, he said, gave a steam consumption of 11.17 lbs. per bhp. In this test the vacuum was 28 ins. and the superheat 182 degs. For reciprocating engines the best results gave 9 lbs. per bhp. This consumption was obtained on a four-cylinder, triple-expansion engine made in Switzerland. The efficiency of a turbine, he said, depended largely on the amount of superheat of the steam. If operated on saturated or moist steam there was considerable friction and erosion of the blades. The effect of superheat and vacuum on a turbine were shown by the fact that there was a difference of efficiency of 23 per cent between a test with 25 ins. of vacuum and 0 deg. of superheating of the steam and a test with 28 ins. of vacuum and 125 degs. of superheat. For each inch increase in vacuum there is an increase of about 5½ per cent in the efficiency.

A general discussion of the subject followed Mr. Kelsay's talk. In response to the question as to whether or not the efficiency of a turbine varied after it had been in service a few years, H. A. Nicholl stated that while he was connected with the Cleveland & Southwestern Traction Company, the 1000-kw turbines in that company's power plant, after a period of two years of operation, gave the same economy as when first put in service. They were, moreover, more economical on any load than were reciprocating engines.

Mr. Kelsay gave the following results of tests on the turbines referred to by Mr. Nicholl: With a load of 1557 kw, or 50 per cent overload, the consumption was 13.6 lbs. per ehp-hour; load 1239 kw, consumption 13.9 lbs.; load 767 kw, consumption 16 lbs.; and load 383 kw, consumption 20 lbs.

President Henry, in concluding the discussion, said it was a most interesting fact that in the adoption of the turbine we are going back to first principles, the first engines having been constructed on the principle of the turbine. Had it not been for the development of electricity, with the demand for a high-speed generating unit, most probably manufacturers would not have returned to this form of motor.

At the December meeting two questions in the question box were referred for answer to Mr. Brady and General Attorney J. A. Van Osdol, of the Indiana Union Traction Company. When called upon, Mr. Brady stated he was prepared to answer both questions, Mr. Van Osdol being absent. The first question read as follows: "Is a conductor on an electric car liable for embezzlement under the Indiana statutes in case he finds a ticket upon the street or in his car and gives it away, to be used by a passenger?"

Mr. Brady said that one statute provided that an employee was liable for embezzlement if he came in possession of a ticket belonging to the company while on duty and disposed of it. The ticket must belong to the company and must be appropriated with the intent to defraud. The statute is meant to apply to tickets not disposed of by the company.

The second question was: "What amount is a legal tender for the payment of fare on an electric railway in Indiana? Is a conductor justifiable in receiving a $20 bill in payment of a 20-cent fare and giving the passenger an order on the company for $19.80?"

The question of what is proper tender in payment of a fare, Mr. Brady said, must be solved by common sense. It is a rule of law that the exact amount due must be tendered. In a case in California it was held that a $5 gold piece for a 5-cent fare was a legal tender, and the passenger recovered damages for ejectment. In New York, however, the court held that the conductor did right when he ejected a passenger because a $5 bill was tendered. The amount constituting a legal tender, Mr. Brady thought, depended upon the practice of the company and the size of the fare. The Indiana Union Traction Company charges $1.40 for fare from Indianapolis to Logansport, and does not require that tickets be purchased at stations. In such a case, Mr. Brady thought, a conductor should furnish change for more than $5. Regarding the second portion of the question, Mr. Brady said that if $20 was a reasonable tender, the conductor should give change and would have no right whatever to give an order on the company.

An additional question submitted was: "Have interurban and street railway companies become sufficiently numerous and wealthy as to make it possible to reduce the important item of insurance premiums by the formation of a mutual insurance company similar to the well-known factory mutual insurance association, which takes care of a certain line of risks?"

The report of the committee on nominations having been called for, the report was presented as follows: President, C. L. Henry; vice-president, Arthur Brady; secretary, F. D. Norveil; and also that H. A. Nicholl succeed A. L. Drum on the executive committee, and Charles Murdock and W. G. Irwin remain on the finance committee. The report was adopted unanimously.

The meeting closed with the report of the treasurer, which showed a considerable balance in the treasury.

THE BANQUET

At the banquet in the evening, Arthur W. Brady, as toastmaster, remarked that the dinner might be regarded as the wake of the Indiana Electric Railway Association, as the committees of the Indiana and Ohio Associations had met and the merging of the two societies was practically assured. After some preliminary remarks, he presented President Henry, adding that Mr. Henry was the pioneer in the interurban railway field in Indiana, and that he assisted in the birth of the first interurban road in Indiana.

Mr. Henry first referred to the loss which the association had met during the year in the death of J. W. Chipman, and to the fact that A. L. Drum had gone to another State. He then described in a most interesting way the history of the Indiana Union Traction Company. Mr. Henry's first plans for this road were made in 1893, and the company was organized in September, 1897. Among those associated with him in the early history of the road were N. J. Clodfelter, Philip Matter, John P. Frenzel, George F. McCullough, Hugh J. McGowan and Randall Morgan. There were many serious problems in the equipment and operation of interurban railways at that time, and the experience on the Indiana Union Traction Company assisted greatly in their settlement. Mr. Henry applied the word "interurban" to this class of road, and this term has since come into very general use, although it is not found in any of the dictionaries.

C. A. Baldwin, superintendent of transportation of the Indiana Union Traction Company, then offered the toast "Our Ohio Association." He welcomed the visitors of Ohio to the Indiana meeting and believed that the decision to amalgamate the two associations, as already outlined, would be profitable to all.

Edward C. Spring, president of the Ohio Interurban Association, upon being called upon, said that it was at first with fear that he crossed the border and stretched forth the hand of fellowship, but that all fear had been dispelled by the hand extended in return. He congratulated the Ohio Interurban Association upon having men like those of Indiana for co-laborers.

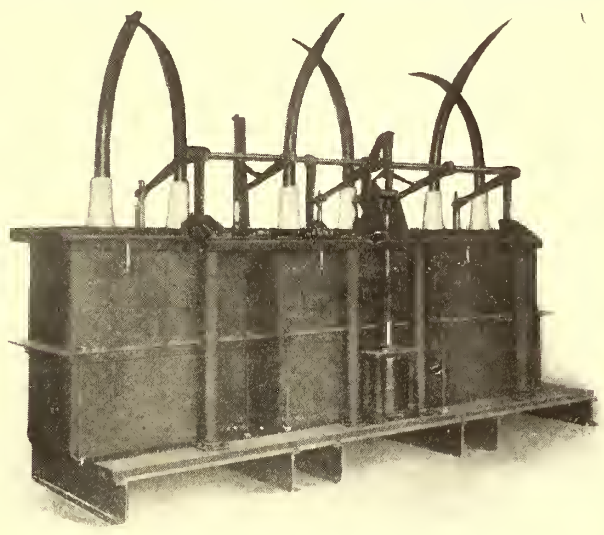
Mr. Drake responded to the toast "Supply Men," and Ernest Bross, editor of the "Indianapolis Star," replied to that of "The Press."

Just before adjournment, President Henry stated that the joint committee of the Ohio and Indiana Associations had decided to hold the first combined meeting of the two associations at Dayton, Ohio, Jan. 25. The following recommendations for officers for the combined association had been made: President, E. C. Spring, of Ohio; vice-president, F. D. Carpenter, of Ohio; vice-president, C. L. Henry, of Indiana; secretary, W. F. Millholland, of Indiana. The committee also recommended that the executive committee of the new association be composed of thirteen members, of which the president and the two vice-presidents would be members ex-officio.

LARGE OIL CIRCUIT BREAKER

The breaker shown in the illustration was designed by the Westinghouse Electric & Manufacturing Company primarily for the Ontario Power Company's work. It is intended to handle energy up to 60,000 hp per three-phase circuit, and will open a circuit under any conditions of overload or short-circuit which may occur with a power house capable of delivering 200,000 hp. The insulation to ground and between terminals is designed to withstand a break-down test of 150,000 volts, and the insulation between poles is twice that amount since the poles are electrically separate.

The three poles of the switch are closed together by means of a toggle joint operated by a single direct-pull solenoid. The



LARGE OIL CIRCUIT BREAKER

switch is held in a closed position by the toggle being carried just beyond the center, and is tripped out by the tripping coil armature striking this toggle and knocking it backward, allowing the switch to open by gravity. Each pole of the switch gives a double break, each break being approximately 17 ins. The closing magnets require approximately 5000 watts direct current, while the tripping magnets require about 300 watts.

The oil tanks, of which there are three, are made of boiler iron, lined with an insulating material, with barriers interposed between the stationary contacts. The contact parts are of the manufacturers' standard type C construction, having renewable arcing tips and contacts. The leads, with their insulation and the upper porcelain insulators, may be readily removed from the switch, giving access to the contact parts for inspection and repairs. The top covers of the tanks are made of treated soapstone slabs, part of which are also removable. Each tank is provided with an oil drain opening in the bottom and an overflow just above the normal oil level. These openings are provided with standard 3-in. pipe flange threads, but no pipe is provided. Each tank has an oil level gage, and requires approximately 160 gals. of oil. The total weight of each three-pole switch complete, the tanks being filled with oil, is approximately 15,000 lbs. The oil alone weighs approximately 4000 lbs.

A two-pole, double-throw, indicating switch is provided upon each three-pole oil switch for use in connection with the controlling and indicating devices. The circuit breaker is not automatic in itself, an overload relay operated from series transformers being necessary.

AN EFFECTIVE ICE-LEVELER FOR BREAKING UP ICE AND HARDENED SNOW

For several years past the Gifford-Wood Company, of Arlington, Mass., and Hudson, N. Y., has manufactured along with other ice-handling devices, the "Eureka" ice leveler, which is specially adapted to break up ice and hardened snow on streets and around railway tracks. Among the railway companies who used this device last winter may be mentioned the Halifax (N. S.) Electric Tramway Company; Consolidated Street Railway Company, of Worcester, Mass., and the International Railway Company, of Buffalo, N. Y.

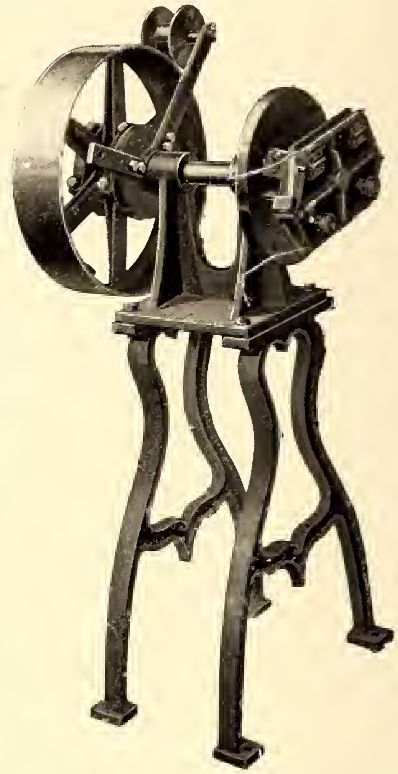
To do effective work with this leveler four horses are required. The wide runners can travel on the car rails by setting the levers in the proper notches, or they can be set for street work independent of the rails, the driver regulating the levers from his seat. The flanged teeth used to break up the ice are made of the best tool steel, well tempered to withstand hard wear before regrinding is necessary. An extra cutter bar, fitted with a full set of teeth, is furnished with every leveler, so that if the bar in use becomes dulled or damaged by stones, the duplicate bar can be immediately substituted, while the dull one is being sharpened. The teeth must not be allowed to become very dull, else they will not feed down below the surface of the ice. It is therefore advisable to have a dozen extra single teeth and bolts on hand besides the additional cutter bar, so that damaged single teeth can be replaced at once. The leveler alone weighs 750 lbs., and with the pole 825 lbs. The length of the cutter bar is 3 ft. 6 ins.; the distance between the runners on the centers, 3 ft. 9½ ins.; extreme width, outside to outside of the runners, 4 ft. 1½ ins.

ICE-LEVELER IN SERVICE ON STREET

The Jest and Song Club, of Schenectady, made up largely of mechanical and electrical engineers of the General Electric and the American Locomotive companies, has received a priceless gift from Robert E. Russell, son of the late Sol Smith Russell, the actor, whose art was known from one end of this country to the other. It is in the form of costumes and music that were used by this eminent actor in his many years upon the American stage, and were accumulated during a historic career of over thirty-five years. Young Mr. Russell is an active member of the club. The costumes will be used for the club's chief theatrical productions and at the coming performances on Feb. 20 and 21.

ARMATURE COIL WINDING MACHINE

The armature coil winding machine made by the Frank Ridlon Company, of Boston, Mass., and shown in the accompanying illustration, is very similar to the field coil winding machine made by the same company, except that it has no back gears and the face plate is designed to take armature coil forms. It is run with a loose belt, but provided with a pulley operated by a treadle for tightening the belt, so that the speed may be under control and any desired tension secured. In winding armature coils, the armature coil form is bolted to the face plate, as shown in the cut. The machine makes a very convenient tool for the shop of every railway doing its own armature winding. The height of the machine over all is 4 ft. 3 ins.; width, 20 ins.; length, 20 ins., and weight, 150 lbs. The frame is of cast iron, the shaft is made of steel and the face plate of wrought iron.



ARMATURE COIL WINDING MACHINE

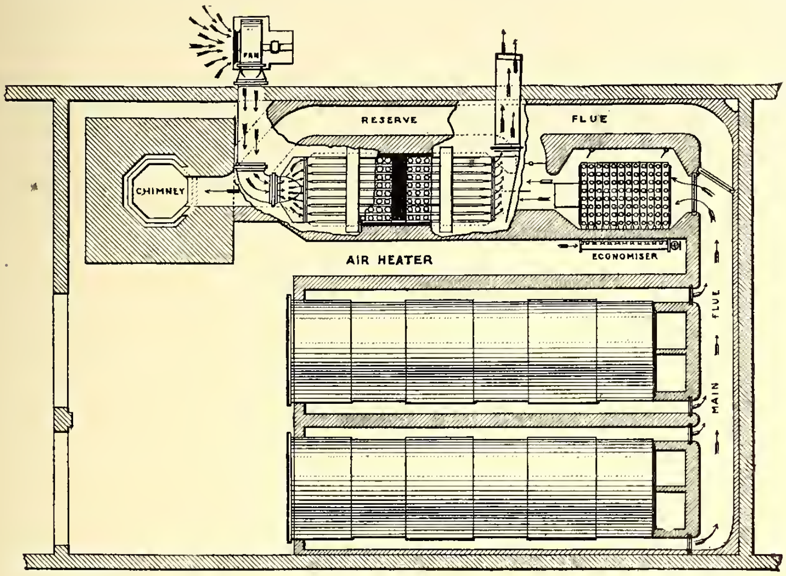
SPECIAL TOOLS FOR REPAIR SHOP WORK

The American General Engineering Company, of New York, is now placing on the market a number of unique machines for street railway shops. Many tools of this kind have been home-made, and this fact has suggested the idea that a market existed for time-saving tools especially fitted for repair shop work. The list includes a self-contained banding machine, giant car pit jack, armature and field coil winding machine, handy armature buggy, adjustable armature coil form, quick break fuse box, and the "perfect" oil cup for armature, axle and pinion bearings. In these machines especial attention has been given to the elimination of all complicated features, and the experience of a large number of roads has been drawn upon in their design. A considerable number of these tools have already been sold to street railway repair shops.

A new transfer check is being issued by the Worcester Consolidated Street Railway Company for the purpose of reducing the use of the transfer as a stop-over ticket. On the new checks every line is given, and they are not good unless used on the next car of that particular line.

AN ECONOMICAL AIR HEATER

Air may be heated and dried, in the same way that water is heated in an economizer, by the waste heat in the flue gases. The Green Fuel Economizer Company, of Matteawan, N. Y., has recently introduced a device for this purpose, called Green's air heater. It is constructed substantially like the well-known Green economizer, with the exception that, while in the economizer all the water enters at the bottom header and passes out from the top header, in the air heater the air is forced by a fan first down through one set of tubes and up through another set, and then down again, and so on until it leaves the heater to be distributed by pipes to armature and field coil drying chambers, car pits, etc.



AIR HEATER INSTALLED WITH ECONOMIZER

The cast-iron tubes of the heater are 9 ft. long between headers, with an internal diameter of 3⅞ ins., and are hydraulically pressed into the top and bottom boxes, which are of a sloping design to insure uniform velocity and distribution of the air in passing over from one series of tubes to the next. The air is kept moving at a good speed, and by this system of frequent redistribution through the tubes there is no possibility of short-circuiting or eddying. There are separate top and bottom boxes for each row of tubes, so that any number of rows may be set up together for any capacity of plant or amount of air required, while the number of groups in series may be increased if it is desired to prolong the time that the air is in the heater in order to bring its temperature nearer to that of the flue gases from which it receives its heat.

The cold air from the blower enters the heater at the end where the flue gases leave to pass to the chimney, while the heated air is taken out at the end nearest to the boiler, where the flue gases are the hottest. In this manner a uniform and high difference of temperature is maintained between the flue gases outside the tubes and the air inside the tubes, a condition required for the most rapid transfer of heat through a given amount of conducting surface.

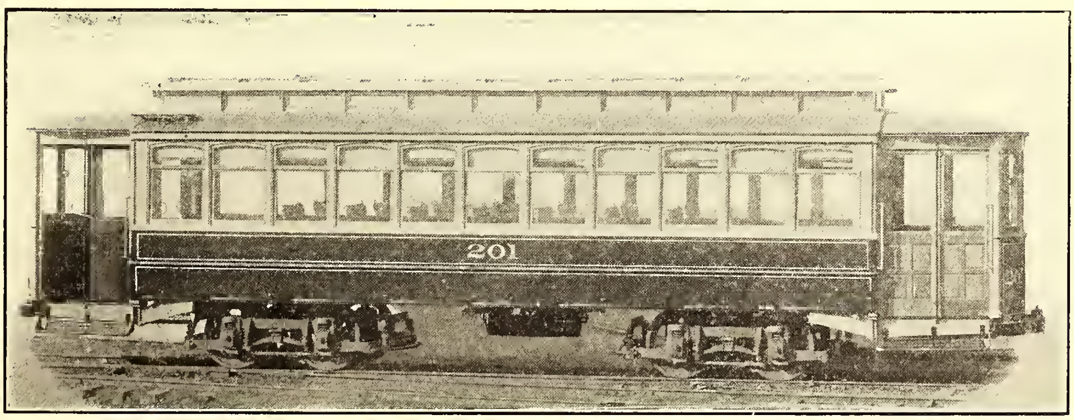
By means of suitable dampers and passages, it is possible to operate the economizer and heater together, separately, or to pass the gases to the chimney directly. Either or both of the devices can be cleaned or repaired while the boiler plant is in operation. It should be remembered that this air heater usually replaces steam heating coils for drying, and thus not only saves as much steam as would be required for the drying, and a corresponding amount of fuel, but, by relieving the boiler plant of this demand for steam, it increases by the same amount the steam available for other uses.

THE LEHIGH VALLEY TRACTION COMPANY'S NEW CARS

The two illustrations of car interiors on page 124 give an idea of the difference between the height of the window sills and the width of the aisles between two semi-convertible cars, one with sashes, which drop into pockets in the side walls, and the other of the Brill type. Both were built by the G. C. Kuhlman Car Company for the Lehigh Valley Traction Company, and both measure 8 ft. 4 ins. over the posts. The one with wall window pockets has 35-in. seats, 19-in. aisle and window sills 30 ins. from the floor, while the seats of the Brill semi-convertible are 37 ins. long; the aisle, 22 ins. wide, and the window sills, 25 ins. from the floor.

There were twenty cars, ten drop-sash and ten semi-convertibles, in the order which was recently completed, and the general dimensions are as follows: Length over the end panels, 30 ft. 8 ins., and over the vestibules, 41 ft. 11 ins.; width over the sills, 8 ft. ½ in., and over the posts at the belt, 8 ft. 4 ins.; the sweep of the posts, 1¾ ins.; the distance between the centers of the posts, 2 ft. 8 ins. The side sills are 4 ins. x 7⅜ ins.; the center sills, 3½ ins. x 4¼ ins., and the end sills, 5¼ ins. x 6⅞ ins. Sill plates 15 ins. x ⅜ in. are in the inside of the side sills.

The car interiors are finished in ash, with ceilings of decorated birch. The longitudinal seats at the corners accommodate four passengers each. The transverse seats have high backs with head roll, and are of the Brill manufacture. The platforms are 5 ft. 6 ins. long, and are supported by a pair of angle irons at the center which extend 4 ft. 9 ins. inside the body bolsters. The outer platform knees are reinforced with angle iron. Iron-pipe uprights at the center of the platform entrances serve as grab handles, and at the same time divide the entrance, so that two passengers may enter or leave at the same time. The cars are mounted on No. 27-G trucks, having a 4-in. wheel base and 33-in. wheels.



DOUBLE-TRUCK VESTIBULE SEMI-CONVERTIBLE CAR FOR THE LEHIGH VALLEY TRACTION COMPANY

The Lehigh Valley Traction Company operates practically all of the lines in Allentown and vicinity. It operates over 150 miles of track and has about 180 cars. The company furnishes power for operating a light plant, and owns Central and Manhattan Parks at Rittersville, both of which are reached by its

INTERIOR OF CAR, WITH WALL POCKETS FOR THE PANELS

lines. The Philadelphia & Lehigh Valley Traction Company, which is controlled by the same interests, has a 50-mile line between Philadelphia and Allentown.

A NEW TRACK CLEANER USED BY THE ROCKLAND, THOMASTON & CAMDEN STREET RAILWAY

For about a year the Rockland, Thomaston & Camden Street Railway, of Rockland, Maine, has been using successfully a track cleaner invented by Valentin Chisholm, the superintendent of this railway. The application of this device is made clear in the accompanying illustrations, of which Fig. 1 shows the track cleaner raised, and Fig. 2 lowered on a single-truck car, while Fig. 3 shows it in the raised position when used on a double-truck car.

The scraper blades, of which one is provided for each rail, are suspended directly from a wooden fender secured to the truck frame and placed in front of the wheels of the truck. The blades are therefore brought very close to the wheels, and as they are suspended from the truck frame rather than from the car, they are not thrown out of alignment with the rails even when the car is rounding a sharp curve. The blades are comparatively wide at the top and narrow at the bottom, each having a scraping edge adapted for contact with the rail. They are connected by a bar and are arranged for raising and lowering the scraping edges. To the connecting bar between the blades is attached a lifting chain operated by the motorman. The connection between the lifting chain and the bar permits lateral movement of the bar with reference to the chain, which would be caused by the relative movement of the car body and truck frame, due to passing around a curve. When the blades are in their lowered position, the bar rests on a ledge, which limits the downward movement of the blades.

INTERIOR OF CAR, WITH ROOF POCKETS FOR THE PANELS

When the blades are not in use, the motorman raises them by means of the chain and supports them in their elevated position by hooking the chain over a suitable pin. It will be noted from the illustrations presented that the blades are placed at an angle with the track so that the snow scraped away is thrown up on the outside of the rails.

FIG. 3.—TRACK CLEANER APPLIED TO FRONT AND REAR TRUCKS OF CAR

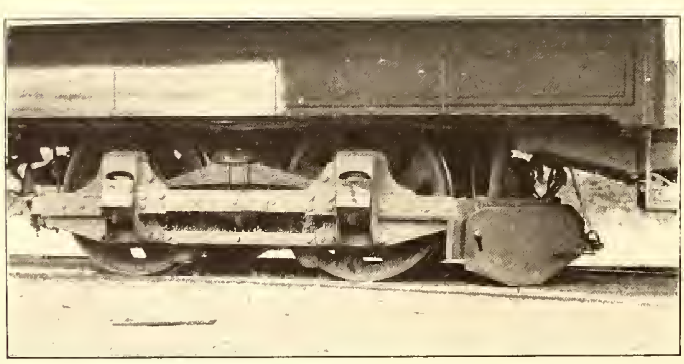


FIG. 1.—TRACK CLEANER RAISED

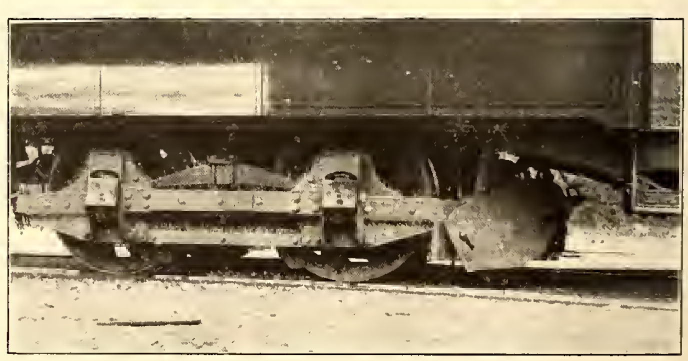


FIG. 2.—TRACK CLEANER LOWERED

FINANCIAL INTELLIGENCE

Wall Street, Jan. 17, 1906.

The Money Market

Monetary conditions have continued to improve during the past week, rates for all classes of accommodations sustaining further sharp recessions, despite an increased demand for funds, resulting from an active speculation in stocks. The comparative ease which has characterized the market was due in a large measure to the heavy influx of funds from the interior, which have materially strengthened the cash reserves of the New York city banks. During the week ending Jan. 12, the gross receipts of currency amounted to more than $17,000,000, being the largest on record for any one week. Since then the inward movement of funds has continued upon a large scale, and as there is every indication of a continuance of the movement in this direction for some time to come, a further relaxation in rates for both call and time loans may be expected. In fact, there is already some pressure of funds upon the market, money being offered in some quarters at 4¾ per cent for six months. The foreign exchange market has ruled firm throughout the week, prime demand sterling being quoted at 486¾, but at the same time the Paris money market has worked easier, thus preventing the exports of gold to that center which were threatened at the close a week ago. A noteworthy feature of the market during the week has been the active demand for American bonds by European investors. Large blocks of American railroad bonds have been purchased during the past week for London, Paris and Berlin accounts, which is regarded in local banking circles as highly important at this time, as the purchases of these securities are likely to have an important bearing upon the foreign exchange situation. The bank statement published on last Saturday was an extremely favorable document. Loans increased only $383,300. Deposits increased $13,463,400. Cash increased $15,603,500, which was considerably more than expected. The reserve required was $3,365,850 more than in the preceding week, which deducted from the gain in cash, resulted in an increase in the surplus reserve of $12,237,650. The surplus now stands at $12,808,650, as against $571,100 in the previous week, $24,459,275 in the corresponding week of last year, $23,181,750 in 1904, $20,217,125 in 1903, $19,061,450 in 1902, $27,256,600 in 1901, and $16,707,350 in 1900.

Money on call has been in active demand and liberal supply at rates ranging from 4 to 8 per cent, the bulk of the business being transacted at 4½ and 5 per cent. Sixty-day money opened at 6 per cent, but later declined, and was offered freely at 5½ per cent. Three to six months' maturities were obtainable in quantities at 5 per cent, as against 5¼ and 5½ per cent quoted a week ago. Commercial paper has been fairly active, specialists reporting an active demand for choice names by out-of-town institutions at 5 and 5½ per cent.

The Stock Market

While some irregularity attended the movements in prices on the Stock Exchange during the past week, the tendency was again unmistakably upward, and the undertone may be described as decidedly strong. The volume of business was not extraordinarily heavy; nevertheless, the market at all times was an active one, and there was unquestionably a further increase in outside interests, as reflected in even larger buying orders through commission houses than was noted in the previous week. In some cases there was distribution of stocks by those who had made purchases at materially lower levels, but on the whole the demand was far better than the supply, with a result that in not a few instances the highest prices of the current upward movement, and in some stocks the best figures on record were reached. Considerable attention was devoted to the foreign political situation, particularly as applied to the Moroccan affair, and this had a tendency to check the rising current at intervals, but apart from this the governing factors were once more of a strong bullish nature. Monetary conditions improved perceptibly, not only as regards rates for both call and time money, but also with reference to the local bank situation, the clearing house institutions having made large additions to their cash resources, chiefly from interior cities. In practically all lines of general trade the same favorable conditions that have been referred to from time to time still prevail, and there was evidence of an extremely healthy condition of affairs in our foreign trade, the Government figures of our exports for December last showing a total value of nearly $200,000,000, much the largest of any month on record, and an excess of exports over imports of $98,553,705, this also being a new high record. The foreign exchange market continued firm, but at the same time the demand for gold at Paris was nothing near so urgent as of late, and in consequence the threatened export movement of the precious metal from this country did not materialize. As on numerous occasions in the recent past the sharpest advances that took place in stock prices were confined to the industrial shares, notably those of the iron and steel and railway equipment companies; however, there were considerable gains in a number of the standard railway shares, not the least important of which were scored by the anthracite coal stocks, on the general belief that a satisfactory arrangement will be made with the miners between now and next April, when the present contract expires. Union Pacific, Great Northern preferred, and several of the trunk line stocks were among the strongest features of the week.

The principal feature of the week in the local traction group of stocks has been the great activity and sharp advance in Brooklyn Rapid Transit, which was generally considered to have some bearing upon the rumors that the company would in some way be included in the merger of all the local traction lines. The shares of the other companies, while generally strong, were comparatively inactive, and the principal disposition appeared to be to await the details of the consolidation, which are expected at almost any time.

Philadelphia

Trading in the local traction stocks has been upon a much smaller scale during the past week, but prices generally have displayed decided firmness. Philadelphia Rapid Transit was again the active feature, upwards of 14,000 shares changing hands, at prices ranging from 32 to 32⅞, the final transaction taking place at 32⅝. Philadelphia Company was more animated than in the preceding week, about 12,000 shares being dealt in at from 51⅜ to 53½, which was the closing figure. Small amounts of Philadelphia preferred brought 50½ and 51. Fairmount Park Transportation gained a point further, 110 shares selling at 18½. Philadelphia Traction was strong, odd lots aggregating more than 300 shares bringing prices ranging from 100⅛ to 101. Small lots of Consolidated Traction of New Jersey brought 80 and 80¼, and near the close 100 shares sold at 80½. Union Traction was fairly active and firm, about 700 shares being dealt in at 62½ and 62¾. Railways General sold at 7, and American Railways changed hands at 52. United Companies of New Jersey sold at 270 and 270½.

Baltimore

Increased activity and strength characterized the trading in traction issues at Baltimore. United Railway issues were, by far, the overshadowing feature, both as regards activity and price movement. In the early dealings the market was extremely quiet, but toward the close there was heavy buying of the stocks and bonds at materially higher prices, on rumors of the purchase of the property by a New York and Baltimore syndicate, and a combination of the public utilities. Subsequent denials of the above rumors caused sharp reactions in prices for all of the company's issues. The 4 per cent bonds opened at 94, and advanced to 94¾, and closed at 94⅜, about $90,000 of them changing hands. The free incomes advanced from 67⅜ to 71½, the highest price recorded in a long time, but later reacted to 69¾, and closed at 70⅝. Nearly $600,000 of them were dealt in. The pooled incomes were traded in to the extent of $380,000, at from 68¼ to 70 and back to 69. The free stock sold to the extent of 9000 shares, at from 15 to 19, and back to 16½, while the deposited stock rose from 15¾ to 19, on the purchase of 23,000 shares. The final sale was at 17⅛. Norfolk Railway & Light 5s were unusually active, $60,000 bringing 97⅞ and 97½. Charleston Consolidated Electric 5s sold at 97 for $57,000. Baltimore Traction 5s sold at 116½ for $2,000.

Other Traction Securities

The market for tractions at Chicago was extremely quiet and without feature. South Side Elevated sold at 97½ and 97¾ for 300 shares. Chicago & Oak Park common changed hands at 7⅜ and 7¼, and the preferred advanced from 26½ to 28½ on the purchase of odd lots. Metropolitan Elevated common was quiet at prices ranging from 26¼ to 27¼, but the preferred was fairly active, about 1700 shares changing hands at from 71⅞ to 72⅛. Northwestern Elevated rose from 66¼ to 67, on the expectations of a dividend on the stock early next month, at a rate not to exceed 4 per cent per annum. The feature of the Boston market has been the activity and sharp advances in Massachusetts Electric stocks. The common, on transactions aggregating nearly 4000 shares, rose from 18 to 19½, and closed at the highest, while about 2500 shares of the preferred brought from 62½ to 70, the final transaction being made at 68¼. Other transactions were: Boston Elevated at 157, West End common at 99¾ and 99 and 99½, the preferred at 113½ and 113; one $1,000 4 per cent bond of 1915 at 102, Boston & Worcester common at 25½, preferred 74½ and 74¾. In the New York curb market Interborough Rapid Transit has been fairly active and decidedly irregular, about 9000 shares changing hands at from 235½ to 236. The securities to be issued by the Consolidated Company were fairly active also, about 2100 shares of the new common selling at from 59½ to 57½, while about 1000 shares of the new preferred brought 99¾ and 99. The new 4½ per cent bonds were fairly active, upwards of $400,000 changing hands at from 95 to 96 and back to 95½. New Orleans Railway 4½s sold at 91¾, and an odd lot of American Light & Traction preferred brought 105.

Security Quotations

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

	Jan. 10	Jan. 17
American Railways	52	52½
Boston Elevated	157	158
Brooklyn Rapid Transit	88⅝	90¾
Chicago City	197	197¾
Chicago Union Traction (common)	10⅞	10
Chicago Union Traction (preferred)	—	40
Cleveland Electric	83	83
Consolidated Traction of New Jersey	81	81
Consolidated Traction of New Jersey 5s	107½	107½
Consolidated Traction (sec. com.), W. I.	—	57½
Consolidated Traction (preferred), W. I.	—	98½
Consolidated Traction 4½s, W. I.	—	95
Detroit United	94⅝	94⅜
Interborough Rapid Transit	234	234
International Traction (common)	36	37
International Traction (preferred) 4s	75½	75
Manhattan Railway	160	160
Massachusetts Electric Cos. (common)	18	18½
Massachusetts Electric Cos. (preferred)	62½	69
Metropolitan Elevated, Chicago (common)	27	28
Metropolitan Elevated, Chicago (preferred)	70	71
Metropolitan Street	124⅜	126½
Metropolitan Securities	73½	74⅝
New Orleans Railways (common)	38½	39
New Orleans Railways (preferred)	84	85½
New Orleans Railways, 4½s	91	91
North American	101⅜	101⅝
North Jersey Street Railway	25	25
Philadelphia Company (common)	51⅝	53⅜
Philadelphia Rapid Transit	32	32½
Philadelphia Traction	101	101
Public Service Corporation 5 per cent notes	95½	95½
Public Service Corporation certificates	69	70
South Side Elevated (Chicago)	96	96
Third Avenue	138	138
Twin City, Minneapolis (common)	120	119
Union Traction (Philadelphia)	62½	63
West End (common)	99	99
West End (preferred)	113½	113

W. I., when issued.

Iron and Steel

The Pittsburg correspondent of the "Iron Age" reports that the United States Steel Corporation has purchased from the valley furnaces 85,000 tons of Bessemer pig for delivery during the first quarter at $17.25, and also 40,000 tons for delivery during the second quarter at an advance. Negotiations for about 50,000 tons additional for the second quarter are pending. When the latter purchase has been consummated, practically all of the surplus Bessemer and basic pig iron in the valleys for the first half of this year will be out of the mine. The cast-iron pipe interests have been the heaviest buyers of pig iron lately. There have been numerous reports of large transactions for American account in the English markets. The structural shops are booking a good deal of work. The open winter thus far has greatly encouraged work which calls for wire products, and the new orders and shipments continue at a rate extraordinary for this season of the year.

CLEVELAND ROADS MAKE BIG GAINS

City and interurban properties in Northern Ohio made remarkable gains in earnings in 1905. The earnings for several of these properties for the years ending Dec. 31, 1904 and 1905, with the per cent of increase, are shown in the accompanying table:

	1904	1905	Increase, Per Cent
Lake Shore Electric Railway	$669,000	$786,000	17.2
Cleveland & Southwestern	475,361	543,226	14.3
Cleveland, Painesville & Eastern	225,000	243,000	8.
Northern Ohio Traction & Light Co.	895,731	964,000	6.5
Cleveland Electric Railway	4,750,000	5,300,000	11.8
Toledo Railway & Light Company	1,752,833	1,917,000	9.3

CHICAGO TRACTION MATTERS

At the meeting of the Chicago City Council Monday evening, Jan. 15, it was decided that the Council meet in a committee of the whole Thursday morning, to consider the traction franchise ordinances and the changes suggested in them, together with the Mayor's $75,000,000 Mueller law certificate ordinance.

Regarding the Harlan amendments to the ordinances and other suggested changes, John P. Wilson, of the Chicago City Railway Company, said:

"I desire to state that we have carried on negotiations with this committee trying to formulate a contract by the terms of which the company would rehabilitate the road and surrender all its rights to the city of Chicago at the end of twenty years.

"I now state that the terms of the ordinance presented to this committee are as burdensome as the Chicago City Railway is willing to accept. If the Aldermen, in committee of the whole or elsewhere, deem it necessary to make vital changes in the ordinance, when they do so the company can give its answer. We do not believe any progress can be made by proceeding on the present lines."

Doubt is expressed as to whether an ordinance satisfactory to all concerned will be agreed upon in time for presentation to the people at the spring election. If no ordinance is agreed upon, the Mayor's $75,000,000 Mueller certificate ordinance will, as stated by one Alderman, be put on the ballot. In regard to this, the Alderman said: "We think public attention has been called so thoroughly to the situation that it will be beaten, and that will clear the air considerably."

CONSOLIDATION IMPENDING AT BALTIMORE

Well-defined rumor has it that the proposed change in control of the United Railways & Electric Company, of Baltimore, will be followed by the consolidation of the United Railways Company, the Consolidated Gas, Electric Light & Power Company and the Baltimore Electric Light & Power Company, under the charter of the Maryland Securities Company, organized in 1902, which has remained dormant since then. Bertron, Storrs & Griscon, of New York, who are negotiating the deal for the purchase of the United Company, are understood to be in control of the rights of the Maryland Securities Company, so credence is given to the statements made. The United Railways & Electric Company now controls all the street car lines in Baltimore and the neighboring county. This consolidation was effected about ten years ago, when the City Passenger line was acquired by the combination of the Baltimore Traction Company and the City & Suburban lines, which had been merged some years previous. The financial plan of the merger was prepared by Messrs. Alexander Brown & Sons. Like the Railways Company, the Consolidated Gas, Electric Light & Power Company is the result of many small combinations. A little more than a year ago Messrs. Bertron, Storrs and Griscom purchased a majority of the stock of the Consolidated Company, but resold it to the Baltimore syndicate headed by S. Davies Warfield, president of the Continental Trust Company. It was soon after this that the gas company was consolidated with the United Electric Light & Power Company. The Consolidated's only opposition is the Baltimore Electric Power Company, but this company may be included in the final plan for the proposed merger. It is said that the syndicate has offered $25 a share for the common stock of the United Railways & Electric Company, a majority of which is pooled by Alexander Brown, George C. Jenkins and Douglas H. Thomas, as trustees, who control, it is said, 75 per cent of the stock, or about $11,250,000.

ENTERTAINMENT FOR BROOKLYN EMPLOYEES

The entertainment arranged for the employees of the Brooklyn Rapid Transit Company by the Brooklyn Rapid Transit Employees' Association is being held this week at the main clubhouse of the association in East New York. As previously stated in the Street Railway Journal, there are two performances every day of a vaudeville bill of eleven numbers, one in the afternoon and one in the evening. Last year only one performance was given daily, except on Saturday, when a special matinee was held for the children, at which prizes were awarded in a series of novel contests between the young folks. Geo. W. Edwards, the secretary of the association, says that the record of attendance last year led to the decision of the extra performance each day so as to keep the evening attendance below 1000, which number can be accommodated with comfort.

The clubhouse is tastefully decorated with flags and bunting. There are a permanent stage and settings, with footlights and theater dimmers. Many of the small cities throughout the country have not, in fact, a place so well suited for entertainments nor so commodious and well equipped. As to the programme of attractions, it is all that could be desired for that particular class of entertainment. Included among those showing are many artists prominent in vaudeville in the Metropolitan district. A review of the programme will serve to illustrate the variety of the entertainment and give an idea of the character of the different features. To begin with, there is an overture on the piano. Then two clever German comedians, vocalists and dancers, entertain. Following them are two young women dancers who entertain with a novelty in which foils are used. A laughable baby farce is next introduced. Picture melodies follow by a very clever male singer, who introduces such popular airs as Starlight, etc. A rural comedy is next. This is followed by a series of remarkable feats at juggling, a feature of which is an act in which five hooples are kept in motion at the same time. Four pickaninnies are the next to entertain; they sing and dance. Feats of tumbling that rank the performances high in their art are then put on. The entertainment is closed with a series of moving pictures.

Thursday evening will be officers night. It is expected there will be an extra large attendance, as the officers have all signified their intention of being present. A feature that evening will be a special concert by the employees' band. The officers of the railway department of the Public Service Corporation of New Jersey have been invited to attend, but it is not known what evening they will come. The officials of the Jersey company are greatly impressed with the work being done in Brooklyn and are watching developments there, as it is said that they have under way on their own system work of a similar nature for the benefit of the men.

A publication to be devoted to the interests of the employees of the Brooklyn Rapid Transit Company is to be issued monthly, beginning March, under the auspices of the Brooklyn Rapid Transit Employees' Association. The new paper is to be known as "The Third Rail." There will be "feature" articles including fiction, and a complete récumé for the month of happenings in the various departments of the company. Distribution of the paper to the employees will be free, and according to plans now under consideration, will be made by the paymaster on salary day. This will insure everyone getting his copy, and eliminate the clerical work that would be entailed by keeping a subscription list. The initial circulation to employees will be upward of 10,000 copies each month. In addition to this, there will be the sales made on the stands of the company's elevated lines, which will make the total circulation more than 25,000 copies, for it is proposed to reach the general public by this and other methods. The price of a single copy will be 10 cents, and for the year $1. The editorial department of the paper will be under the direct supervision of C. A. Parker, of the company, who will have as his assistant Percy Edrop, of the New York "American." The advertising will be managed by J. A. R. Studwell, who now controls the advertising privileges in the company's cars and on the elevated stations, and also operates the paper and candy stands on the stations.

In connection with the new paper, a novel subscription scheme has been started. To every member of the benefit association has been sent five certificate blanks, each of which represents the value of one year's subscription to the magazine, with the request by the officers of the association that the member use his best endeavors to sell the certificates, the price being only $1 each, 20 cents of which he will be allowed to retain for the time and labor devoted to the cause. The name of the person to whom the certificate is sold must be written on the face of the certificate, and a record of the sale entered on the stub, the stub then to be torn from the certificate and returned, together with the 80 cents, to the head of the department in which the member addressed is employed. As a further inducement to increase the circulation of the paper, the following prizes will be awarded by the association for the largest number of subscriptions sold by individual members: First prize, $50; second prize, $20; third prize, $15; fourth prize, $10; fifth prize, $5. The prize contest will close on April 1.

LOUISVILLE COMPANY TO MAKE IMPORTANT IMPROVEMENTS

Improvements and extensions, involving the expenditure of not less than $750,000, and possibly $1,000,000, are to be made by the Louisville Railway Company this year. The plans, as outlined in a general way, comprehend the addition of a storage battery to the power equipment; the installation of two turbines; the extension of the Eighteenth Street road line 4 miles beyond its present terminus; the probable extensions of all the interurban lines of the company; the purchase of a large number of new cars, and the building of 10 miles of new lines in the city. It is understood that the improvements will be financed by the issuance of common stock to the value of $1,000,000, which has been authorized but never used. Final action on this matter will be taken at the annual meeting of the stockholders of the Louisville Traction Company, the holding corporation of the Louisville Railway Company, in February. The company has power to issue $400,000 in second mortgage bonds, which would pay for part of the improvements, but it is understood that the most popular plan is to dispose of common stock. The plan to dispose of the common stock at par would give the stockholders the right to subscribe for nine shares for each 100 shares owned by them.

NEWTON & NORTHWESTERN COMPLETING PLANS

The officials of the Newton & Northwestern Railway Company, which operates a steam line from Newton northwest to Rockwell City, Ia., have completed plans for making Fort Dodge the northern terminal, and work will be started in the spring on the construction of an extension from a point on the present line in Boone County to Fort Dodge. President H. Loring was in Fort Dodge recently making the necessary arrangements for carrying out the work. The plan includes the purchase of the property of the Fort Dodge Heat, Light & Power Company, which is now operating the heating and lighting plants in that city and also the street railway system; the construction of the extension above noted, which will be equipped for electric interurban service for passengers and operated as a steam line for freight. The City Council has already granted the Newton & Northwestern the right to lay track from a connection with the street railway tracks on Central Avenue and Sixteenth Street, along Central Avenue to Twenty-First Street. From Twenty-First Street the new road will run south, crossing the Great Western and Illinois Central tracks by means of overhead crossings on its way to the gypsum fields south of Fort Dodge. Thence the road will run south across the Des Moines River to a point on the present line of the company near Lanyon, Webster County. This extension will be about 20 miles in length. The survey has already been completed and much of the right of way contracted for. Associated with Mr. Loring is the banking house of Poor & Company, of Boston and New York. These houses financed the construction of the extension of the Newton & Northwestern from Fraser to Newton, and from Gowrie to Rockwell City. They recently took the property over and elected Mr. Loring president. Mr. Loring has departed for the East, where he is to let the contracts for the electrical equipment of the new extension. It is understood that the Newton & Northwestern will either equip its main line from Lanyon to Goddard and connect at that point with the Colfax line of the Interurban Railway Company of Des Moines, or else the section between Lanyon and Boone, and connect at Boone with the Des Moines-Woodward line of the Interurban Company, when the extension is built from Woodward to Boone. It is more than likely, however, that the officials of the Newton & Northwestern will conclude to electrify the entire line, as the road has never been a paying investment. If this be done, connections could be made for the Des Moines service at Boone and Goddard. While in Fort Dodge Mr. Loring made the statement that through electric service would be established between Fort Dodge and Des Moines just as soon as the necessary arrangements could be made after the construction of the extension noted above.

LONG ISLAND RAILROAD ORGANIZES HOLDING COMPANY FOR ELECTRIC PROPERTIES

The Long Island Consolidated Electrical Companies, the entire capital stock of which is owned by the Long Island Railroad Company, has been organized as a holding company for the purpose of taking over the control of the various subsidiary electric lines owned or controlled by the Long Island Company, as well as such other electric lines as may be purchased or constructed as feeders to the lines of the Long Island Company in the future.

An authorized issue of 4½ per cent 40-year collateral trust mortgage gold bonds, not to exceed in the aggregate the amount of $10,000,000, is designed to cover the cost of acquired and constructed subsidiary electric lines, and to provide for the future development and extension of these and similar properties.

The electric lines above referred to as owned by the Long Island Company to be turned over to the Long Island Consolidated Electrical Companies are as follows: Huntington Railroad Company, Ocean Electric Railway Company, the Northport Traction Company, the Nassau County Railway Company, the Glen Cove Railroad Company, the Jamaica & South Shore Railroad Company. These lines were purchased, constructed and equipped at a cost, to Nov. 1, 1905, of $779,235. The Long Island Company also owns one-half of the capital stock and bonds of the New York & Long Island Traction Company, and will acquire one-half of the capital stock and bonds of the Long Island Electric Railway Company, at a total cost, for its interest in both companies, of $1,360,507. These securities are also to be turned over to the Long Island Consolidated Electrical Companies. These latter named properties were purchased jointly by the Long Island Company and the Interborough Rapid Transit Company, controlling the subway, elevated and surface lines in New York for the purpose of controlling and aiding in the local development of Long Island.

As shown above, the amount expended upon these properties for which bonds will be issued approximates $2,140,000, and it is expected that about $500,000 additional will be expended for new lines and extensions during the year 1906. The surplus earnings of these lines are estimated at $100,000 per annum, and should be ample to take care of all fixed charges. By this means the Long Island Company will be enabled to provide the necessary capital, for some time to come, to acquire or construct such local electric lines as may be useful and necessary in building up and protecting its local traffic without having to draw upon its own treasury.

A special meeting of the stockholders of the Long Island Railroad Company is to be held in the office of the company in Long Island City, on Wednesday, March 14, for the purpose of considering and taking action upon a proposition to guarantee the payment of principal and interest of the bonds of the Long Island Consolidated Electrical Companies to an amount not to exceed $10,000,000.

TERMINAL STATION FOR PHILADELPHIA

The Philadelphia Rapid Transit Company is reported to have completed negotiations with the Philadelphia & West Chester Traction Company for extensive terminal facilities at the intersection of Sixty-Fifth and Market Streets, Philadelphia. As a result, the Rapid Transit Company will erect a joint passenger station that will cost upwards of $100,000, and the Philadelphia & West Chester Company will erect a trainshed west of the station that will cost more than $50,000.

The management of the Philadelphia & Western Railroad, which is building a line from Sixty-Third and Market Streets westward to Wayne and Parkesburg, has about completed negotiations with the Rapid Transit Company for the use of the proposed passenger station, and it also wants the use of certain terminal track facilities. The contract will probably be signed within the next sixty days.

Plans for the passenger station have been drafted under the direction of Chief Engineer Twining. The station will be so constructed that the three railroads named will be able to have a joint waiting room. The West Chester Traction Company will erect its trainshed immediately west of the station. It will have accommodations for five trains. The shed will be used by the express trains to be installed between that terminal and West Chester, and by the Philadelphia & Garrettford electric road, which will run trains to Clifton Heights. The station and trainshed will be on the south side of the loop to be formed by the elevated railroad on the old Sellers tract of land.

The Philadelphia & Western Railroad will have its tracks on the north side of the elevated loop. An overhead bridge will connect the platform used by this road with the passenger station. Passengers from either of the suburban lines desiring to board the elevated cars will do so by way of wide stairways descending from the overhead passageway. It is the purpose of these three roads to operate express trains without change from the center of the city to the terminals of the suburban lines as soon as the subway work is completed.

A. I. E. E. BUILDING FUND

The General Electric Company, in view of the great importance and utility of the United Engineering Building as a home and center for the engineering professions and arts, has made a contribution of $25,000 to the land and building fund of the American Institute of Electrical Engineers. President C. A. Coffin, who takes a warm personal interest in the matter, has also sent his own check for $5,000. The committee, which had already received gifts and pledges amounting to nearly $70,000, is greatly encouraged by this generous support of its work. The fund is now, with other new subscriptions, well over $100,000, and with renewed energy the committee has begun its canvas of the field, with the object of securing a second necessary $100,000. About 600 members have already subscribed to the fund, and the committee expects to have no difficulty in at least doubling this number. It has just issued to the whole membership a handsome pamphlet, illustrating and describing the new building in course of erection in New York City, and detailing the steps that have been taken by the associated engineering bodies to give effect to Mr. Carnegie's original gift.

REORGANIZATION OF HUDSON VALLEY RAILWAY

The consent of the security holders of the Hudson Valley Railroad Company to a plan which will permit the reorganization of the company without foreclosure is being sought by a committee composed of John W. Herbert, James H. Caldwell, E. Clarence Jones and Frederick J. Lisman. The circular to the security holders says that if a receivership and foreclosure are rendered necessary by the failure of all the security holders to co-operate under the proposed plan of reorganization, a new mortgage will have to be recorded and the fixed charges of the company will be annually increased between $15,000 and $20,000, owing to the operation of the recently adopted law imposing an annual tax of one-half of 1 per cent on all new mortgages. The committee says that if a foreclosure is permitted a much heavier scaling down of the company's securities would be necessary than that which is now proposed.

It is proposed, in addition to the existing 5 per cent consolidated mortgage bonds amounting to $4,000,000 and $3,000,000 of common stock, to issue $700,000 of 5 per cent non-cumulative debenture A bonds and $2,500,000 of 2 per cent debenture B bonds. It is provided that after two years the B debentures may be converted into 5 per cent non-cumulative preferred stock. The holders of the present consolidated bonds are asked to surrender to the treasury of the company 20 per cent of their holdings of these bonds and to accept for the surrendered bonds an equal amount of debenture A bonds.

The holders of Hudson Valley Railway demand notes outstanding to the extent of $202,125 are asked to accept an equal amount of debenture B bonds. Other amounts of the B debentures will be issued in even exchange for the rentals due by the Hudson Valley Railway Company and for the guaranteed stock of the North River Railway Company, which is leased to the Hudson Valley Railway Company. The Hudson Valley Railway Company car trust notes amounting to $30,000 will be paid off in cash to be provided by the sale of debenture B bonds at 30.

It is proposed to sell at this price $1,500,000 of these bonds, which will supply $450,000 in cash. The right to subscribe to these bonds at the rate of $5,000 for every hundred shares of stock is given to the holders of the company's common stock. The cash provided in this way other than that needed to pay off the car trust notes will be used to liquidate the floating debt, for improvements, and for general expenses.

The present common stock, according to the plan, is to be put in a voting trust for five years, the trustees named being John W. Herbert, E. Clarence Jones and James H. Caldwell. The trustees will have the right to sell all the stock upon the written consent of two-thirds of the holders of the voting trust certificates. The committee, it is said, directly controls three-quarters of all the company's securities.

Bonds of the Hudson Valley Railway Company were among the assets of the Merchants' Trust Company when that institution went into the hands of receivers. The Merchants' Trust Company held $861,000 of these bonds as security for notes for $746,862. These bonds were sold by the receivers of the Merchants' Trust Company last fall.

MOVING PLATFORMS FOR PASSENGER TRAFFIC

A dinner was given at the Waldorf-Astoria on Jan. 15, when Capt. Max E. Schmidt described and illustrated by lantern slides the application of the moving sidewalk to the passenger traffic of New York and Brooklyn bridges, as well as to other purposes of arterial travel in Greater New York. Capt. Schmidt was the inventor and engineer of the moving platform of this character installed on the long pier at the Chicago World's Fair in 1893. The subject was discussed by such prominent city officials as Comptroller Metz and ex-Comptroller E. M. Grout. There was a consensus of opinion that, while it might be difficult to apply the system to the old Brooklyn Bridge until such time as it is taken in hand for renovation and double-decking, it could be adopted immediately for such structures as the Williamsburg Bridge and the still incomplete Manhattan Bridge. Among those present were: General Eugene Griffin, L. B. Stillwell, Edward D. Adams, James C. Bayles, Stuyvesant Fish and T. C. Martin. Capt. Schmidt is to deliver his lecture again at an early date before the New York Electrical Society.

NEW SUBWAY CONSTRUCTION COMPANIES

A new company for the construction and operation of subways is being formed in Brooklyn, with J. Edward Swanstrom at its head. Mr Swanstrom was president of Brooklyn Borough under Mayor Low. The company will, it is said, be capitalized at $100,000,000. William C. Redfield, a manufacturer of Brooklyn, is one of Mr. Swanstrom's colleagues in the venture. Mr. Redfield, who was Commissioner of Public Works during the Low administration, is vice-president of the Home Trust Company, of Brooklyn, of which Mr. Swanstrom is president. Other men whose names are talked of in connection with the undertaking are Silas B. Dutcher, president of the Hamilton Trust Company, and David H. Boody, ex-Mayor of Brooklyn.

It is also announced that a syndicate had been formed to finance a railroad corporation to bid for the franchises of the routes laid out by the Rapid Transit Commission on the West and East Sides of Manhattan and in Brooklyn. The syndicate is composed of the same elements that constitute an embryo railroad company and a tunnel company already in existence. The tunnel company is the New York & Brooklyn Tunnel Company. It will not bid, however, for the rapid transit routes, but confine itself to the building of the tunnel. James E. Clark is mentioned as the head of the movement to organize the syndicate. Within a few days a franchise authorizing the construction of a tunnel under the East River has passed by purchase into the hands of the powers controlling the Interborough Railroad Company. This franchise permitted the building of a tunnel from a point on Park Row, near Ann Street, under the East River, to a point in Brooklyn not far from Park Avenue. The owner of this franchise is the New York & Brooklyn Railroad Company. A controlling interest, or about 51 per cent of the stock of this company, was owned by the Manhattan Transit Company, of which Joseph H. Hoadley is the head.

STATEMENT FROM BELMONT REGARDING SUBWAY BIDS

In a letter sent to the Brooklyn Transit Reform League a few days ago, August Belmont made his first announcement since the merger of the Interborough and Metropolitan Railway systems concerning his attitude on the question of subway building in all parts of New York City, and particularly in Brooklyn. He declared that the old policy of the Interborough Company of competing for all subways which are to be built, with a view to making a complete system throughout the city, would be the policy of the merger of which he is now in control. He said the Flatbush Avenue extension, in Brooklyn, would be pushed to completion without delay. Mr. Belmont's letter follows:

"In answer to your first question, the merger of the Interborough and Metropolitan does not alter the situation as far as the early completion of the Flatbush extension is concerned. It is being pushed with all possible vigor.

"In answer to your second question, the merger will not change the policy of the Interborough with regard to extensions. If there is any change it would be forced by the hostility of those who have arrogated to themselves representation of the city's interests, as well as of personal interests. They have assumed that the combined companies are incapable of conducting transpartation properly and have charged them with the intention of refusing to serve the public. There need be no public anxiety occasioned by the adjustment of transportation matters in New York City.

"The combined companies seek to promote the efficiency of their service on sound and stable lines of operation, to the end that the public may be better served and that rapid transit facilities may be more speedily extended between the several boroughs."

CHANGE IN PERSONNEL IN BALTIMORE

Dating from Jan. 1, James R. Pratt will fill the office of assistant general manager of the United Railways & Electric Company, of Baltimore. This is a newly created office, and has been established to relieve General Manager William A. House of much of the routine of managerial work. Mr. Pratt began service with the company as motorman in 1891, and then changed to become a conductor. He kept this position for two years and was then taken into the claims department. He studied law in the meantime and was made an assistant claim agent. In 1900 he was made assistant to the general manager, and the following year became head of the claims department, which position he relinquishes to become assistant general manager of the entire property.

Coincident with this change, announcement is made that E. J. Paige, formerly assistant claim agent, has been made claim agent; H. C. Wells has been appointed assistant claim agent, and George Blatchley has been made assistant superintendent of transportation, vice Howard Foreman, deceased.

Mr. Paige started with the company in 1893 as a conductor, serving in that capacity for five years, when he went into the claims department, in which he has since served. Mr. Wells began service with the company as conductor in 1892, and after six years' service went into the department of which he has been made assistant. Superintendent Blatchley began his service on the cars and for some time has been chief inspector in the transportation department.

CONVENTION OF THE SOUTHWEST ELECTRICAL & GAS ASSOCIATION

A meeting of the executive committee of the Southwestern Electrical & Gas Association was held recently at the Oriental Hotel, Dallas, Tex. In addition to regular routine business, the following matters of interest were passed upon. It was voted that the association establish a question box, to be divided into the following departments: Electrical railway, electrical lighting, gas, telephone. C. A. Stichter was elected editor, H. S. Cooper, associate editor for the electrical railway department; C. A. Shock, for the telephone department; W. S. Rathell, for the gas department; J. W. McLendon, for electric lighting.

There were several invitations for holding the next annual convention before the committee. It was voted that in as much as the convention has never been held in Galveston, that the invitation from that city be accepted, and the convention be held there about the middle of May. The president appointed the following committee on entertainment: H. S. Cooper, Galveston; David Daly, Houston; Frank J. Duffy, Beaumont.

The president also appointed the following committee to secure papers for the next annual convention: H. T. Edgar, Ft. Worth; J. P. Crerar, Denison; E. W. Dunaway, Dallas.

Several applications for membership in the association were acted upon favorably.

PROPOSED INTERURBAN FOR DELAWARE

U. G. Glick, president of the Smyrna, Kent County & Delaware Bay Traction Company, of Dover, Del., was in New York last week in conference with Constructing Engineer Charles H. McCarthy, of Chicago, regarding the construction of the company's proposed line. Mr. Glick says that work will be begun soon, and that the line will be constructed from Clayton to Woodland Beach through Smyrna, a distance of 9 miles, and to Dover, the State Capital. Eventually, the entire county will be traversed, the new line to connect with a similar road to be constructed in Sussex County.

The organization of the company and the taking out of articles of incorporation in Delaware have necessarily been delayed, pending an opinion from the Secretary of State relative to a forfeit of $35,000 now held by the State for non-compliance in constructing the road. President Glick now says that the new company will make a deposit with the Secretary of State and when the road is completed for the first 9 miles, ask for a refunding of the forfeit of the old company, the rights of which are now owned by the Smyrna, Kent County & Delaware Bay Company.

In order to lessen the delay in constructing the road, the company will make a proposition to the City Council of Smyrna to purchase the electric light and power plant there, with the intention of enlarging it to meet the requirements of the railway and to furnish power to the towns of Smyrna and Clayton and to private consumers along the route of the road.

CHANGES IN PERSONNEL OF PUBLIC SERVICE CORPORATION

A number of important changes were announced last week in the personnel of the railway department of the Public Service Corporation of New Jersey. The position of superintendent of transportation has been created and promotions have been made of a number of division superintendents. Newton W. Bolen, heretofore district superintendent of the lines of the company in Hudson, Bergen and Passaic Counties, has been appointed to the position of superintendent of transportation, in which he will have entire charge of this department, with offices in Newark. Under his jurisdiction will come all the lines in the State. The district superintendents will all report to Mr. Bolen. This change will permit Albert L. Stanley, the general superintendent of the railway department, to devote more of his time to the executive duties of his office.

NEWTON W. BOLEN

Mr. Bolen became connected with the Public Service Company in 1903, under General Manager W. W. Wheatly. The first few months of his service were devoted to a study of the traffic problem of the separate systems then recently consolidated, with a view to recommendations as to the operation of the lines as a unit. After he had finished this work Mr. Bolen was appointed to the position he has just relinquished. He has been connected with the company continuously since 1903, except for a short term of service under Mr. Wheatly with the Mexico City Tramway Company.

Before becoming connected with the Public Service Corporation, Mr. Bolen was with the Brooklyn Rapid Transit Company. He entered the employ of a constituent of the present Brooklyn company when a mere boy, and was advanced until at the time of his leaving he was superintendent of the Flatbush and Bergen Street divisions under General Superintendent Dow L. Smith. It was during Mr. Bolen's connection with the Brooklyn company that the movement had its inception which has resulted in the present elaborate employees' beneficial organization there, and to Mr. Bolen's care was entrusted the details of arranging the employees' rooms at the Crosstown depot, the first in Brooklyn to be so equipped. During the Spanish-American War, Mr. Bolen rendered valuable service to the Government as an attaché of the War Department, in which capacity he assisted in the work of arranging the movement of troops from the East to the point of embarkation.

A change has been made in regard to the management of the lines heretofore under Mr. Bolen's supervision, the duties being divided between E. L. Williams and W. B. Graham. Mr. Williams, who was division superintendent of the Jersey City lines, will act as district superintendent of lines in Hudson and Bergen Counties, while Mr. Graham will have charge of the Passaic County lines, included in which are the lines in Paterson. Both Mr. Williams and Mr. Graham were also formerly connected with the Brooklyn Rapid Transit Company. Mr. Williams was assistant to E. F. Reeves when the city operated the shuttle train service over the Brooklyn Bridge, and became associated with the Brooklyn railway system when the bridge railway property was taken over by the Brooklyn Rapid Transit. He has been connected with the Public Service Corporation since 1903. Mr. Graham was until recently general superintendent of surface lines of the Brooklyn Rapid Transit Company. He was formerly connected with the Twin City Rapid Transit Company, from which he went to Brooklyn in 1902.

A. J. Bliss, division superintendent of the Hoboken lines, has been appointed to succeed Mr. Williams at Jersey City, and G. C. Dust has been transferred from Paterson to Hoboken. Mr. Bliss has been in the employ of the company a number of years. Mr. Dust formerly was with the St. Louis Transit Company, serving in the traffic department.

By the changes, the office of traffic superintendent is abolished. John N. Akarman, who held that position, will fill the newly created office of general passenger agent. Mr. Akarman was formerly general manager of the Worcester Street Railway system. The office of James Leahy, who resigned as superintendent of maintenance and way more than three months ago, is filled by the series of promotions. Martin White, who was one of Mr. Leahy's division men and was roadmaster of Division A, will take his place. P. A. Clerkin, of Jersey City, takes Mr. White's place as roadmaster of Division A. He will have his offices in West Hoboken. The changes also create the position of chief engineer of maintenance and way. This position will be filled by Martin Schreiber, one of the company's corps of engineers.

BANQUET OF THE OHIO ASSOCIATION

The second annual banquet of the Ohio Interurban Railway Association will be held at the Algonquin Hotel, Dayton, Thursday, Jan. 25, at 6 p. m. The banquet committee consists of Edward C. Spring, chairman; Harrie P. Clegg, F. W. Coen, A. W. Anderson, R. A. Crume, John F. Ohmer, E. B. Wright, E. B. Grime. A number of prominent street and interurban railway officials and other well-known men will attend. Business meetings of the association will be held in the morning and during the afternoon of Jan. 25.

DEVELOPING FREIGHT PLANS IN MASSACHUSETTS

A certificate of incorporation has just been issued from the office of the corporation department in Massachusetts which is expected to have an important bearing on the development of electric railway express business in that State. The certificate goes to E. P. Shaw, Walter E. Simmons and William R. Buckminster, constituting them and their associates a corporation to be known as the Boston Suburban Securities Company, "to finance or assist in financing any firm, association or corporation engaged in the transportation of express matter," and "to dispose of the securities, or property, or business of established express lines."

The interesting thing about this new corporation is its possible relation to the voluntary association organized some time ago under the name of the Boston Suburban Express & Parcel Company, which was regarded as a merger of a number of suburban and other express companies with a view to establishing systems for distribution and collection of matter to be transported between cities by the express-carrying trolley lines. E. P. Shaw is president of that company, and express interests already established are understood to hold a goodly proportion of the stock. Now comes the new company, also with Mr. Shaw at its head, evidently planning to act as a holding company for the association or any other companies that appear in the trolley-express situation in Boston.

The new corporation's capital stock named in its certificate is $40,000, divided into 400 shares. Of these Mr. Shaw is down as holding 266, Mr. Simmons 133, and Mr. Buckminster 1. Mr. Simmons is understood to act as financial representative of A. Shuman, who is at the head of the well-known clothing house in Boston and a leading member of numerous commercial organizations in the city. Mr. Buckminster is the lawyer who attended to the legal details of the incorporation.

The fact that E. P. Shaw is the father of James F. Shaw, of the Boston & Worcester Street Railway, has led to an assumption that the express company combination is intended to further the plans of the Boston & Worcester Company. At present the project appears much broader than this, however. That the new company is likely to have a field of considerably greater breadth, is indicated by the rapid progress toward freight and express privileges recently made by the Old Colony Street Railway. The work of the Old Colony among the local authorities in its territory—the southeastern district of Massachusetts—has already been noted in these columns; and on Monday last the company took the next step required under the Massachusetts law and petitioned the Railroad Commissioners for their approval of its rights to act as common carrier of express and freight in the cities of Brockton and Taunton, and the towns of Easton, Raynham, Dighton, Rehoboth and Sekonk. These towns indicate a line of traffic from the important shoe city of Brockton to Taunton, a mill city, and thence to Providence and the steamship lines centering there, the entrance into Rhode Island territory being effected over lines with which the Old Colony already is understood to have an agreement. This development of express business around Taunton may affect the similar development which has recently been pushed on the Taunton & Pawtucket Street Railway, and the old Bristol County line, which was taken over some time ago by the firm of Choate, Hall & Stewart, of Boston.

It is reported that the Georgia Railway & Electric Company will extend its line on Peachtree Road from Brookwood to Buckhead, which is 10 miles from Atlanta. The roadway will be widened 30 ft., making it 80 ft. wide.

AN IMPORTANT MOVE OF A LARGE COMPANY

Announcement was made last week that Rossiter, MacGovern & Company had decided to enter the engineering and contracting field as engineers and contractors for all classes of work. A specialty will be made, however, of engineering and contracting for steam and electric railways and electric power plants. The company has recently increased its capital to double what it has previously been, and has elected J. C. Brackenridge president. The new capital is being supplied in large part by Mr. Brackenridge and others whom he has brought in as stockholders in the reorganized company.

Mr. Brackenridge is well known in the traction field through his connection with the Brooklyn Rapid Transit Company, first as chief engineer and later as general manager. His association with

J. C. BRACKENRIDGE

F. S. MACGOVERN

the Brooklyn Rapid Transit Company extended over a period of ten years, during which all of the more recent power stations of the company were built, the greater part of the elevated railway system electrified, and the operation of the cars extended over the present Brooklyn Bridge, all of which was accomplished under his immediate supervision. Mr. Brackenridge resigned from the Brooklyn Rapid Transit Company two years ago to accept the position of Commissioner of Public Works, of Brooklyn, which office he occupied until the first of the current year.

Frank S. MacGovern, under whose able direction the present success of the company has been attained, continues as vice-president and general manager, and James R. Floyd, Jr., as treasurer. Clinton L. Rossiter, who was formerly president, has resigned from that office, but remains a member of the executive committee and is still actively connected with the company.

Rossiter, MacGovern & Company have enjoyed a most prosperous career since they commenced business. The enterprise was started about fourteen years ago to engage in the purchase and sale of electrical and steam apparatus. An excellent reputation was soon established, and business increased so rapidly that it became necessary to incorporate the firm seven years ago. During recent years the amount of the company's actual sales of electrical apparatus has been exceeded by that of few, if any, of the electrical manufacturing companies in the country outside of the very largest. As an adjunct to its business, the company established sometime ago a repair shop in Jersey City and offices in St. Louis and Boston. The plans of the company to engage as engineers and contractors will not interefere with its present well established business of the purchase and sale of electrical and steam apparatus of all kinds. In fact, the company proposes to erect another large repair shop in the neighborhood of New York, on the water front, to replace its present shop in Jersey City, but the location of this shop has not yet been decided.

The board of directors of the company is a strong one, and includes J. C. Brackenridge, Frank MacGovern, Clinton L. Rossiter, D. H. Valentine, who is a director of the Brooklyn Rapid Transit Company, and Edward Rossiter, treasurer of the New York Central & Hudson River Railroad.

INTERURBANS SEEK TO ENTER MILWAUKEE

Franchises for two electric railways have been asked of the Common Council of Milwaukee, one by the Milwaukee-Northern Railroad Company, to enter the city from the north, and the other by the Chicago & Milwaukee Electric Railway Company, coming from the south.

The Milwaukee-Northern Company asks a franchise ordinance granting it the right to build an electric street railway from the north city limits, near Sixth Street, almost in a direct line south to the southern city limits, passing through the downtown district. It is proposed to make this line a part of an interurban system which eventually will run from Fond du Lac to Sheboygan, thence down the lake shore to Kenosha, where it will connect with the line to Chicago. Franchises are also being asked of the Common Councils of Port Washington, Sheboygan, Fond du Lac and Cedarburg.

A thirty-year franchise is asked. The proposed ordinance provides for a 3-cent fare in the city "until the company shall have constructed cross lines so that transfers can be issued"; that the company must construct lines wherever the Common Council believes there is a reasonable necessity therefor; that the tracks of the company may be used by any other interurban system which shall acquire a franchise and which shall fairly compensate the Milwaukee-Northern for the use of the tracks; that the Milwaukee-Northern must pay one-third of the expense of building the disputed portion of the Sixth Street viaduct if the Milwaukee road cannot be compelled to pay for it, and that the company shall care for the streets between its tracks.

In consideration for the franchise the company agrees to furnish the city with sufficient electricity to operate all of its swing and bascule bridges. Firemen, policemen and health officials will be permitted to ride free in the city, and the city will be given the right to purchase the property of the company within the city limits at a cost price to be determined by arbitration. The franchise contains clauses relating to the care of streets, and the replacement of pavements in good order after they are disturbed by the company. The company is required to file a bond of $25,000 to carry out the provisions of the ordinance, and it is provided that 2 miles of road must be in operation within 15 months after the franchise is accepted. The principals back of the Milwaukee-Northern Company are Messrs. Comstock, Haigh and Walker, of Detroit.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED JAN. 2, 1906

808,679. Disappearing Seat; Charles K. Pickles, Philadelphia, Pa. App. filed Feb. 9, 1905. An aisle seat and back adapted to be folded, lowered and stored beneath an adjacent seat.

808,716. Brake System; Charles E. Barry, Schenectady, N. Y. App. filed Aug. 13, 1903. Relates to an air brake system provided with novel means for reducing the brake pressure gradually as the speed decreases.

808,773. Surface Contact Electric Railway; George H. McFeaters, Johnstown, Pa. App. filed Aug. 15, 1904. A contact box having an upper fixed electrode and lower movable electrode, a flexible conductor connecting the moving electrode with the supply side of the system, and a diaphragm of insulating material below the movable electrode and covering the flexible conductor to prevent arcing.

808,778. Motor Control System; William B. Potter, Schenectady, N. Y. App. filed Aug. 10, 1904. Relates to a system of operating cars from 500-volt circuits, and high potential alternating circuits at different times. Transformers are employed for stepping down the high potential alternating current to about 200 volts, at which it may be utilized on the ordinary series motor.

808,783. Trailing Fender; Emmet G. Solomon, Omaha, Neb. App. filed Nov. 20, 1903. A folding framework projecting from the rear of a car to prevent persons passing behind said car in front of a car approaching on the other track.

808,797. Track-Sanding Apparatus; Friedrich W. Wittkowsti, Des Moines, Ia. App. filed Feb. 27, 1905. The discharge pipe is rendered flexible by telescoping connections whereby it will swing with the truck when rounding curves.

808,852. Trolley Device; Frank J. Ludolph, Rochester, N. Y. App. filed July 18, 1905. The harp is made in two parts and provided with adjustable journal boxes for the trolley axle. The spokes of the wheel are formed of stud bolts, which can be screwed inward so as to remove and replace the tread portion of the wheel.

808,904. Combination Rail and Tie Fastener; Francis M. Crossley, Dayton, Ohio. App. filed Sept. 21, 1905. A clamp adapted to be slipped over the end of a metallic cross-tie is provided with a lip for engaging the flange of the rail and a set screw for holding the same in position.

808,905. Walk-Over Car Seat; Samuel M. Curwen, Philadelphia, Pa. App. filed May 16, 1904. A wall plate for walk-over seats, having mortises of varying depth and socket-pieces fitting the mortises and adapted to receive portions of the back of the seat.

809,028. Automatic Safety Railway Crossing; Thomas Squires, Mariposa Township, Ontario, Can. App. filed April 29, 1905. When the vertically swinging gates are lowered at the intersection of steam and trolley roads, switches are closed on each trolley track to switch an approaching car onto a track parallel to that of the steam road.

809,120. Electric Railway. Charles Levinson, New York, N. Y. App. filed July 18, 1905. Means for preventing the starting of a train until the gates have been closed, consisting in locating a plurality of switches in the driving motor circuit of every car of the train, said switches being operated by the gates.

809,226. Wire Carrier; Frank L. Sessions, Columbus, Ohio. App. filed July 17, 1902. The hanger is provided with clamping levers thereon which engage the wire ends and tighten them into alinement with one another when the clamping levers are spread apart.

809,236. Electromagnetic Switch-Setting Apparatus and Electric Rail Heater; Bruno O. Wagner, Swissvale, Pa. App. filed March 9, 1905. A reciprocating electric motor contained in a casing adapted to operate the switch point. Also comprises a casing secured to the under side of the switch rail base-plate, and containing a plurality of heating coils embedded in suitable material.

UNITED STATES PATENTS ISSUED JAN. 9, 1906

809,434. Rail-Joint Chair; Aurelius M. Ewing, Seattle, Wash. App. filed Sept. 11, 1905. Comprises superimposed plates adapted to be interposed between the rail and a tie and each extending laterally upon both sides of the rail, the upper plate being folded upon itself for engagement with the base flanges upon one side and the lower plate folded over and embracing one extended side of the upper plate and for engagement with the base flange of the opposite side.

809,536. Rail Joint; Charles H. Stephens, Bartlett, Tex. App. filed Aug. 17, 1905. Embodies a tie plate or base provided with a longitudinal groove to fit the base of the rail and with a spring splice-bar and fish-plate rigidly secured to the base and gripping the side of the rail under the shoulders of the latter.

809,627. Brake-Shoe; William H. Namack, Ballston, N. Y. App. filed May 2, 1905. Comprises a body and a lug having longitudinal and transverse openings therein and consisting in part of bifurcated portions partially embedded in said body.

809,630. Trolley Attachment; Edward D. Rockwell, Bristol, Conn. App. filed May 17, 1905. A yoke-shaped contact block adapted to be easily and quickly fitted into the trolley harp in case the wheel wears out when the car is at a distance from the stable or repair shop. The device may also be used to remove ice from the trolley wire.

809,632. Anchor Emergency Air Brake; Charles Z. Sanders, Sacramento, Cal. App. filed May 1, 1905. A pair of clamping jaws pneumatically actuated to grip the rail.

809,658. Brake-Shoe; Horace L. Winslow, Chicago, Ill. App. filed Feb. 17, 1905. Comprises a back plate having depending lips, inserts having a dovetailed connection with the lips and a body having a dovetailed connection with the inserts.

809,707. Pneumatic Train-Control System; John B. Linn, Schenectady, N. Y. App. filed Oct. 16, 1902. A spring-pressed piston is moved varying distances within each car by the train-pipe pressure which serves to successively uncover ports in the side walls which lead to the successively pneumatically-operated conductors.

809,728. Electrical Heating System; Arthur D. Newton, Hartford, Conn. App. filed July 9, 1904. A car-heating system having a circuit which includes the heaters and an automatic switch that is opened and closed by a magnet which is included in a circuit which includes a thermostat that is engaged by contact which moves into various positions according to the amount of current the motors are using.

809,747. Hanger or Ear for Overhead Electric Trolley Wires; Abraham Richardson and Thomas S. Jones, Blackpool, England. App. filed Feb. 6. 1905. Consists of a pair of jaws having tapering shank portions and a threaded nut or sleeve adapted to force the jaws into clamping relation.

809,773. Emergency Operating Means for Reversing Switches; Frank E. Vase, Schenectady, N. Y. App. filed Aug. 23, 1904. Connections from the reversing switch to each end of the car in such a manner that by operating a lever upon either platform the switch will be thrown to give motor connections for movement in a direction reverse relatively to that platform.

809,774. System of Control; Frank E. Case, Schenectady, N. Y. App. filed June 12, 1905. A pneumatic train-control system in which a circuit breaker in the motor circuit is opened upon exhaustion of the pneumatic system when the motor circuit remains energized, but not when the motor circuit is de-energized.

809,794. Railroad System; Hannibal C. Ford, Jamaica, N. Y. App. filed Sept. 12, 1905. Automatic means for stopping a train in case the engineer passes a certain signal above a certain speed.

809,829. Street Car Fender; William Martin, Wilkinsburg, Pa. App. filed Sept. 1, 1905. When an obstruction appears upon the track the motor releases a dog and the fender is thrown to operative position by spring means.

809,908. System of Control; Frank E. Case, Schenectady, N. Y. App. filed Oct. 1, 1904. A motor controller having electromagnetic actuating means, pneumatically-actuated devices for governing the operation of the controller actuating means, two pipes associated with the pneumatically-actuated devices and means for supplying said pipes with compressed fluid.

PERSONAL MENTION

MR. JAMES MILNE, of Toronto, has accepted the position of general superintendent of the British Columbia Electric Railway, of Victoria, B. C.

MR. EDWARD TAYLOR, formerly engineer of equipment and tests of the Brooklyn Rapid Transit Company, of Brooklyn, N. Y., has become sales agent for the H. W. Johns-Manville Company, of New York, for Milwaukee and the territory thereabout.

MR. W. E. REYNOLDS, assistant general manager of the Massachusetts Electric Railway, and Engineer Bancroft, of that company, who were in Toronto recently, made a careful study of the fare-box method of collecting fares in use in that city.

MR. FRANK SILLIMAN, JR., has resigned as general manager of the Scranton Railway Company, of Scranton, Pa., following the change of ownership mentioned in a recent issue. Mr. Silliman has been manager of the Scranton system since 1895.

MR. J. V. W. REYNDERS has been elected vice-president of the Pennsylvania Steel Company, and will have full charge of all the company's affairs at Steelton. Mr. John W. Dougherty has been appointed general superintendent of the Steelton works.

MR. W. H. FOLEY has resigned as cashier of the Fort Wayne & Wabash Valley Traction Company, of Logansport, Ind., and has accepted the position of chief clerk and cashier of the Atlantic City & Suburban Traction Company, with headquarters at Pleasantville, N. J.

MR. HARRY B. RENWOOD, formerly assistant division superintendent of the Mt. Clemens division of the Rapid Railway, of Detroit, has been appointed superintendent of the Lansing & Suburban Traction Company, to succeed Superintendent Street, who has resigned to take up another line of work.

MR. S. C. SCHENCK, who was formerly prominently connected with the railway detail department of the Westinghouse Electric & Manufacturing Company in its New York office, has resigned his position to become general manager of the Sterling Varnish Company, of Pittsburg, Pa. He will be located in Pittsburg permanently.

MR. CHARLES R. BELLAMY, general manager of the Liverpool Corporation Tramways, died Dec. 23. Eleven days previously Mr. Bellamy tripped on the steps of his house and injured the calf of his leg. His death was attributed to the clotting of an artery from the heart to the lungs, which was accelerated by the injury to the leg. Mr. Bellamy has been manager of the tramway system since 1898, and had previously been city lighting engineer. Mr. Bellamy visited this country about two years ago, in company with his son, and inspected a number of the American systems.

MR. JOHN P. FEENEY, claim adjuster of the Public Service Corporation of New Jersey, died at his home in Jersey City a few days ago, of a complication of diseases. Mr. Feeney was born in Jersey City in 1859. In 1889 Mayor Orestes Cleveland appointed him Police Commissioner. He was also a member of the Assembly for three terms. In 1892 Gov. Leon Abbett made him chief of the State detective force. At the expiration of his term he became adjuster of claims for the North Jersey Street Railway Company, in which post he was continued by the Public Service Corporation when the lines in New Jersey were consolidated. He leaves a widow and two children.

MR. ROBERT MATHIAS, who has been connected with the Frank Ridlon Company and the Chas. N. Wood Electric Company for the past five years, has accepted a position in the street railway department of the Stuart-Howland Company, of Boston. Mr. Mathias graduated from the University of Pennsylvania in 1895. Since that time he has held the position of station electrician with the New York Edison Company and chief electrician for the Baldwin Locomotive Works, of Philadelphia, but more recently has devoted his attention to street railway work. He is well known in the electrical field, and should prove a valuable acquisition to the selling force of the Stuart-Howland Company.

Street Railway Journal

Vol. XXVII. NEW YORK, SATURDAY, JANUARY 27, 1906. No. 4.

Published Every Saturday by the

McGraw Publishing Company

Main Office:

NEW YORK, Engineering Building, 114 Liberty Street.

Branch Offices:

Chicago: Monadnock Block.

Philadelphia: Real Estate Trust Building.

Cleveland: Cuyahoga Building.

London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York"; "Stryjourn, London"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada, Mexico and the Canal Zone.

Street Railway Journal (52 issues)....................$3.00 per annum

Single copies ....10 cents

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August and November) $4.00 per annum

Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy)....................$6.50 per annum

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues), postage prepaid.................... $6.00

25 shillings. 25 marks. 31 francs.

Single copies....................20 cents

Remittances for foreign subscriptions may be made through our European office.

NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the Street Railway Journal.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires.

Of this issue of the Street Railway Journal 8000 *copies are printed. The total circulation for the year* 1905 *was* 424,350 *copies, an average of* 8160 *copies per week.*

Electric Freight Traction on Trunk Lines

We publish elsewhere some notes on trunk line traction, by H. Ward Leonard, that are especially instructive in their point of view. We are wont to hear electric traction discussed mainly from the viewpoint of motive power, and the gains to be made by substituting an efficient central station and system of distribution for relatively uneconomical locomotives, or as a means of quickening and improving passenger service. Mr. Leonard treats the question as involving the general principles of economical operation as applied to that class of service for which the railroads depend for their main revenue—i. e., heavy freight haulage. It is a common thing for experienced railway managers to assert that passenger traffic, especially fast passenger traffic, does not pay, and granting this, it follows that if electric traction is to meet a really enthusiastic reception on trunk lines it must show cause for adoption on something more than a small and unprofitable fraction of the work to be done. We have always regarded the scorn of passenger traffic as somewhat hypocritical and intended mainly to forestall the frequent protests of exasperated passengers, but be that as it may, there is no denying that the freight business is the mainstay of railway earnings, and that any new methods must be applicable to that business in order to show adequate reason for existence.

Mr. Leonard takes the position that the key to cheap haulage is in the use of larger train units and greater power in the locomotive, thereby reducing the cost per ton-mile, irrespective of incidental gains in cost of motive power as such. Certainly the broad facts of the freight business bear out this point of view, showing that increased economy comes with the longer trains and the more powerful locomotives that have been in vogue in the last few years. Also the electric locomotive undeniably has a large advantage in that its whole weight is on the drivers available for adhesion, its power is easily brought up to the maximum that can be utilized with the given adhesion, and can be maintained at that maximum hour after hour, so long as may be necessary. More than this, electric locomotives can be coupled together in the same train and worked together with each held up to its full power all the time, whereas it is well known that it is difficult so to use steam locomotives, so that when two are used it is mainly for the purpose of insuring that each of them shall be pushed to full power in turn while its mate is temporarily recuperating. In point of fact, there is the best of reason to believe that the electric locomotive will enable a considerable saving to be made in the mere cost of motive power, and will have a considerable advantage in maintenance cost, owing to the far smaller number of wearing parts.

We think Mr. Leonard's points are well taken, since it is certainly feasible to provide electric locomotives more powerful than any steam locomotives now in use and to work them together efficiently. In grade climbing such machines have very material advantage, owing to their large weight on the drivers and to their capability of being forced to considerable overloads without any serious loss of efficiency. For such use of electric locomotives, it is obvious that those able to utilize high voltage on the working conductors are necessary, whether with a. c. motors or with Mr. Leonard's well-known plan of a. c.-d. c. operation. Certain it is that he has made out a strong case for electric traction in the very place where it has generally been passed over in silence. This large view of the subject is worth study on the part of railway managers. Perhaps the experience to be gained in the Sarnia tunnel, referred to in the last issue, may tend to their greater enlightenment.

The Canadian "Coffeepot" System of Collecting Fares

We are able to print in this issue two valuable contributions descriptive of the portable fare-box system now generally used throughout Canada for collecting fares, as well as an interesting discussion of the results, after a year or so of use, of the type of car used in Montreal in which passengers pay as they pass from the platform into the car. This plan is so novel, except in Montreal, that the exposition of its merits should prove of great interest. The "coffeepot" system is general throughout Canada, and our readers are probably more or less familiar with this system in general, but so far as we know this is the first time an explanation of the method in detail has been printed in this country. The system is, of course, not new, as it has been in use for upward of twenty-five years in Canada, and to some extent in Europe, but it is believed the explanations of the workings of the system and the result secured, as given by Canadian officials on another page, will be read attentively by managers on this side of the line, in view of the gradually increasing disposition to seek remedies for some of the more glaring shortcomings in our present way of collecting fares.

Whatever may be said about the cumbersomeness of the fare-box collection and the obstacles in the way of introducing it in this country, the fact remains that with its use the Canadian companies are getting all the fares collected on their cars and the fares of practically everybody who rides. This is sufficient to mark the system as one worthy of the most careful consideration. Moreover, as a matter of fact, the portable box is really the only logical evolution from the old stationary fare box in the corner of the car, so familiar in horse car times. With the coming of the electric car and the advent of conductors, we in the States abolished the fare box altogether. Across the line they merely made the box smaller and gave it to the conductor to pass among the passengers.

Considering the matter purely from a theoretical standpoint, the box collection in many respects approaches the ideal. There is no middle man to handle the company's cash, and there are no leaks. Moreover, it is held in Canada that the system sets a high standard of integrity and encourages honest conductors. At the same time it removes temptation from the path of the weak ones. In this connection we have always tried to retain our faith in human nature, and we venture the opinion that in honesty and moral integrity, as a class, street car conductors stand as high as any large body of men in which there are as many new recruits from year to year as there are with conductors. If they did not, considering the loopholes in our present system of collecting fares, it would be impossible to run cars at all according to present methods. We hold the opinion that nine-tenths of all the trouble that occurs comes from a very small number, relatively speaking, who drift into the business of conductors as they would and do into many others. We thoroughly believe the great army of the rank and file of street railway employees are honest men, and if some of them sometimes drop away from the high plane of exact rectitude, it is the looseness of the system that is responsible. It is all so easy to find more nickels in one's pockets than are indicated on the register at the end of the run that the temptations would try character of stiffer caliber than can be secured for 20 cents an hour. Therefore the fare box encourages honest conductors and helps get rid of bad ones.

The impression in the States has always been that the fare box collection was slower than the usual method. The only competent evidence we have on the subject is the testimony of prominent officials of Canadian roads who are thoroughly familiar with the practice in the United States as well as in their own country, and this testimony is unqualifiedly to the effect that the Canadian system is no slower. In modification of the testimony, however, it must be borne in mind that the public in Canadian cities have been educated to the use of the fare box and the people make it a custom to facilitate the work of the conductor. Whether or not the American public would do the same is entirely a matter for actual experiment.

So far as we know, the portable box has never been given a fair trial in this country. We believe spasmodic attempts have been made to introduce a few boxes in one or two cities. But American managers have appeared to take the attitude that the box collection could not be started here because either the conductors would refuse to carry the boxes or else the public would object to being compelled to deposit their own fares. But we are not so sure that either of these things would happen. Naturally, in introducing an innovation of this kind, there might be some opposition until everybody understood all the whys and wherefores, but we are inclined to believe that if any manager became convinced that the fare box would overcome the defects of the present system, he could introduce the box system with no more opposition than would come from the few chronic kickers—provided, of course, he frankly took employees, the press and the public into his confidence and let everyone know what he was doing. It is frequently true in the street railway business that public opposition comes from ignorance of what is being done. The change could not be made arbitrarily and with high-handed disregard for public opinion, but with frankness and a little educational work it could be brought about—assuming always that the game would be worth the candle.

Improvement of Property Along Interurban Lines

There are two very significant facts which must of necessity attract the attention of every ordinarily observant person who has occasion to travel upon the long interurban railway lines in the Middle West, and who is at all interested in the development of the country and the building of this class of road. The first is the marked improvement in the appearance of the individual properties along the line, whether they are in the villages or in the open country. In some cases this takes the form of the grading of the lawns, or the planting of flowers and ornamental shrubs. In other instances, and this is true in the country, it manifests itself in the painting of buildings, the repairing of fences and outbuildings, and in other ways, which seem to show in unmistakable language that the owners and occupants of the property have awakened to the fact that they are in touch with the world and desire to let others know that they realize this fact. Although this improvement may not add directly to the actual value of the physical property of the railway company, it is one that must be gratifying to all lovers of "picturesque America," and proves conclusively that these great arteries of commerce are stimulating and benefiting to those sections of the country through which they pass.

Another feature, which is particularly marked in Michigan, is the construction at a great many of the cross roads near the line, of barns or sheds for the care of the farmers' horses during the time they are gone to the city or town. This indicates clearly the creation of a new class of business on the part of farmers and others, who, instead of driving anywhere from 6 miles to 10 miles to town, leave their horses in charge of some responsible person at the nearest point on the electric line and ride in on the car, carrying their lighter produce with them and bringing back their purchases. In this way they save not only themselves, but their horses, from a long and tedious drive over a poor or indifferent road.

This class of business, although quite noticeable in some localities, is still in its infancy, and seems worthy of attention upon the part of the owners of electric railway lines, as it cannot fail to add largely to the popularity as well as the profits of the road. While it may be true that the companies would not be justified in the building of such barns or sheds themselves, there are no doubt many places where a little encouragement, and possibly a little financial assistance upon their part to some one living in the locality, might result in the establishment of many such stations that would bring to the company an increase in business and popularity in the farming sections.

The development of this class of business also clearly demonstrates that the electric railway is not necessarily a rival of the steam railroad, but that it occupies a distinctive field of its own; that it creates a business that the steam road could not serve, and adds largely to the comfort, convenience and benefit of the rural residents of the territories through which its line passes, by providing them with a much quicker, better and more satisfactory means of reaching their town markets.

The Crowding of Cars

Every little while the attempt to regulate the habits of the traveling public turns up in a new form. It is ostensibly some device for preventing the overcrowding of cars, aimed apparently at the "soulless corporation," that is popularly regarded as a fair mark for anyone with a grudge against things in general. Sometimes it takes the form of a no-seat no-fare agitation; again it crops up as an ordinance regarding ventilation, and the outbreak which just now has called the subject to our mind is a call for regulations against overcrowding. Now, in the last analysis, the crowding of street cars has as its cause the determination of a large proportion of the passengers to ride between specified points within certain narrow limits of time. So long as this determination persists there will either be overcrowding or part of the crowd will have to walk. It is very easy to talk about the duties of corporations, but it is not a question of either duty or inclination. These same "soulless" corporations would greet with open arms and checkbook anyone who would tell them how to deal successfully with the conditions that embarrass them. It is a condition, and not a theory, that confronts them. When it comes to the problem of providing seats for passengers, the ordinary long closed car will seat thirty-five to forty people, and, running on a minute headway, will accommodate therefore about 2000 passengers per hour. At 30-second headway, which involves the certainty of frequent time-consuming blockades on any ordinary surface line, about 4000 passengers can be seated. This number is far less than that which will be poured out of the shops and offices of a single business block during the evening rush hour in a great many cities in this country.

Even if one could run enough cars to seat eighty or one hundred people a minute without interminable delays, during certain periods in the evening rush, the crowd swarms into the street in the business section of a large city at several times that rate and cannot be promptly taken care of by any feasible number of cars. Therefore any overcrowding ordinance means that part of the crowd must wait or walk during the rush hours. We would really like to see the Continental system of refusing passengers after the seats are filled tried in any large American city for just about one week. It would take the whole police force to prevent a riot after the first day. If the ordinance were modified to allow standing passengers up to half the number of seats, the difficulty would be relieved only to a very minor and insignificant extent. The fact is that during the rush hours in a large American city the traffic is at times so dense that it cannot adequately be taken care of by any practicable number of cars, overcrowded or not, so long as it initiates mainly along one or a few streets, as is generally the case. In the smaller cities it would be physically possible to run cars enough to handle the crowd more successfully, but only by an enormous increase of rolling stock, and the accompanying and very serious difficulty in getting a sufficient supply of extra men. It is altogether out of the question to provide a car per minute on an ordinary urban line, since the number of cars required and of employees to run them a couple of hours per day would become preposterously great. Unthinking people often say that the profit is in the passengers who stand, but the real fact is that the conditions at the rush hours, with the demand for a great stock of cars idle most of the day, and the carrying of enough extra men to run them, together with the formidable peak on the power station load, all go to make up a combination that is very far from economical.

Almost any road would fairly tumble over itself to accept a no-seat no-fare ordinance if it could receive therewith a guarantee of uniformly distributed traffic. Any practical solution of the overcrowding problem must include not coercion of the railway company, but education of the public and co-operation in furnishing locations for car lines. The hardest condition to be contended with is the massing of traffic at certain points within the space of a few minutes. Better routeing of cars in the crowded section of the city, so as to distribute the traffic over several lines from several neighboring termini, may often give considerable relief. We think, too, that there is a very decided limit to the advantage to be gained by shortening the headway. Too many cars not only lend to blocks, but also may act to maintain congestion. For example, suppose a certain line devotes its energies to securing extras enough to give a 1-minute service between 5 p. m. and 6 p. m. The result of this concentration of rolling stock is a very sudden change in the headway before and after this time, and people soon get into the way of riding at this very period in order to get a car more quickly. The same number of cars distributed over two hours more uniformly would often give better results. A service passing suddenly from 2-minute to 10-minute headway, sharply at 6 p. m., insures a jam just prior to the time of change, which could be relieved by better distribution. In other words, the habits of the riding public are somewhat susceptible to modification, and by the exercise of tact can sometimes be changed for the better. Rules about overcrowding are very difficult to enforce after one passes the actual seating limit, and we are inclined to think that they are likely to produce more harm than good. If the cars are frequent and well distributed through the busy hours of the afternoon, which they should be, overcrowding will generally tend to correct itself to a certain extent. A stern limitation on standing passengers will likewise in the long run punish the passengers rather than the transportation company. We do not think the American public can for a long time be educated up to the point of being denied access to a car in which standing room remains, and if they ever reach that point they will also be ready to exercise, on their own account, some discretion in forcing their way upon cars already well filled. At the present time the entire police force would hardly be sufficient to enforce a "no-seat no-ride" ordinance in most American cities.

THE CANADIAN SYSTEM OF COLLECTING FARES

As may be generally known, the electric roads in Canada have almost universally adopted a system of collecting fares that is radically different from that in vogue in the United States. The Canadian conductors do not themselves handle cash fares or tickets collected on the cars, but present to the passenger a small box or bank, commonly referred to as a "coffee pot," and the passenger deposits his own fare through a slot in the top of the box. The slot is fortified with a set of carefully poised teeth of hardened steel, which permit the entrance of a coin or a ticket, but once any article enters 1/3 in., the teeth grasp it and it cannot be withdrawn. Each box is fitted with a security lock, which cannot be tampered with or opened except with a key in the office of the company. At the end of his run, the conductor turns in his box with its contents, and does not at any time touch or handle the actual fare. On most of the roads there is no register or record made of the fares as they are collected, the contents of the box alone being accepted as the indication of the number of passengers carried. One or two of the Canadian companies, however, as an aid in checking, are introducing registers in the cars, and require conductors to register each fare as it is deposited by the passenger in the box, but this practice has not yet become general.

COMPTROLLER'S OFFICE, TORONTO RAILWAY, SHOWING DISPOSITION OF CASH AND TICKET-COUNTING CLERKS; ALSO FARE BOXES ON TRUCKS

In view of the widespread interest that attaches to suggestions for eliminating any of the short-comings of the present system of collecting fares in use in the United States, it has been thought desirable at this time to place on record a description of the Canadian system and a statement of the results secured. At the request of the STREET RAILWAY JOURNAL, Robert J. Clark, assistant comptroller of the Toronto Railway Company, and H. E. Smith, comptroller of the Montreal Street Railway Company, have courteously consented to describe in detail the methods of collecting, counting and handling fares on their respective roads. The systems in these two cities may be accepted as typical of Canadian practice:

COLLECTING AND HANDLING FARES ON THE TORONTO RAILWAY

By R. J. Clark, Assistant to Comptroller

As a matter of fact, the Canadian fare box is a logical development of the old-time stationary box formerly used in horse cars, wherein the passengers deposited their own fares under the general supervision of the driver. As traffic increased, and for general convenience, the idea was developed of having the conductor pass the box among the passengers instead of making the passengers go to the box, and this is the evolution of the present Canadian system. While making no attempt or pretense to argue the superiority of the portable box system over the method of collecting fares as practiced in the United States, it is in order to say that the box system as applied in this city at present is meeting all requirements for the safe and sure collection and retention of all fares.

So far as we have record, the first portable fare box was brought to Toronto about twenty-three years ago. This was an odd looking affair, shaped somewhat like a crescent, to fit around the conductor's waist. The present box has been evolved by gradual stages from the earlier designs.

As to the details of the box itself, the form now most widely used throughout Canada consists of a small compact two-compartment bank or safe, constructed entirely of steel, covered with leather of suitable quality and color. The dimensions are 8½ ins. x 5¾ ins. x 2½ ins., and the cubical contents about 32 ins. The box is carried by a hollow handle at one corner. In the top surface of the box is a small opening or slot through which the coin or ticket is deposited. In the latest improved forms, this slot is guarded with a system of carefully poised teeth of hardened steel, sharpened to a chisel point, and kept in place by their own weight and fine springs. These teeth give way to allow the entrance of any article of the thickness of writing paper up to the thickness of a coin, but once the article has entered the slot for a distance equal to the smallest fraction of an inch, the teeth instantly grip the article and it cannot be withdrawn. Less than 1/8 oz. downward pressure will deflect the teeth, but by actual test they will resist 300 lbs. reverse strain. With the present box the company is absolutely certain that if the fare in the form of coin or ticket is once inserted in the slot, no matter how slightly, it cannot be withdrawn, but must pass wholly within the box.

After the coin or ticket has dropped through the slot it is caught in a small compartment forming the upper portion of the box. This receptacle is fitted with small glass windows, which enable the conductor to scrutinize the fare deposited and detect any attempt to defraud by passing spurious coins or tickets. The floor of this compartment is a tipping table or trap, and after the conductor has satisfied himself as to the genuineness of the fare, he pushes a button in the top of the box, thereby tipping the trap and causing the fare to fall through into the lower compartment or magazine, where it remains until the box is opened by the comptroller's department. The company is thus asured it is receiving every fare collected.

The box is usually carried by the conductor in his left hand, leaving the right hand free to make change, give signals, etc. The box is presented to each passenger, who places the fare, either cash or ticket, in the opening on the top of the box. Strict injunctions are given that the conductor must not handle the fares. If a passenger requires change, the conductor must give the passenger full change and the latter then places the fare in the box. The box generally used throughout the Dominion is made by the Coleman Fare Box Company, of Tottenham, Ont. Can.

The question was asked at the Philadelphia convention of the Street Railway Accountants' Association of America if the box method of collecting fares was slow, to which question W. G. Ross, managing director of the Montreal Street Railway Company, and the writer, replied in the negative. The box system is not of itself appreciably slow, but it should be remembered that the conductors of this company are not only required to collect fares and give signals, but to sell at least five different classes of tickets and issue transfers.

Under the terms of its franchise, the Toronto Railway Company is required to sell five different rates of fares on the cars, and the conductors have to carry from $20 to $25 in tickets and change. In order that they may have sufficient money, the company loans each conductor $25, taking his receipt and a bond from one of the leading insurance and indemnity corporations.

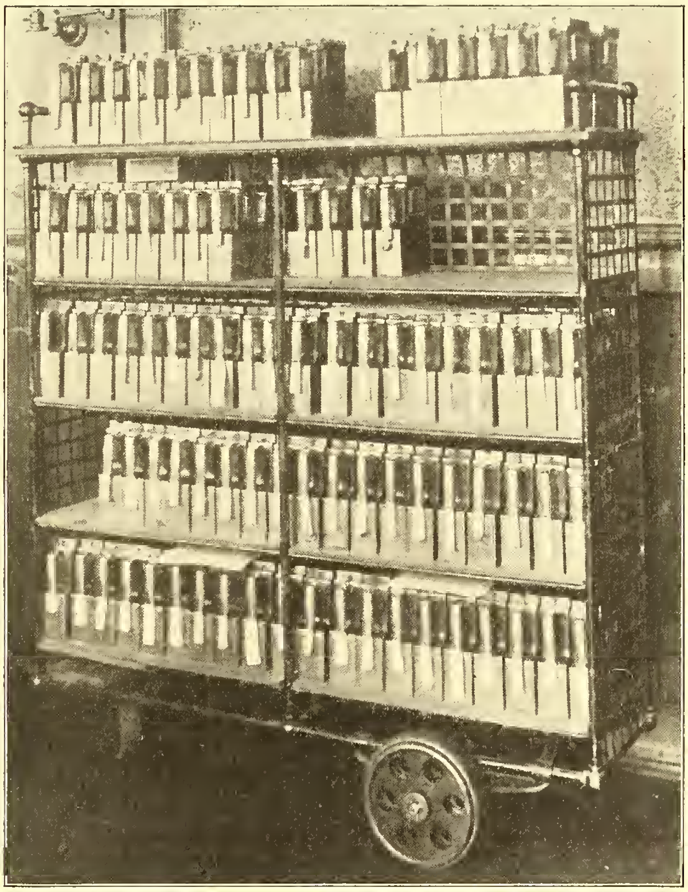
The manner of handling, distributing and accounting for the boxes is as follows: We require twice as many boxes as there are conductors operating cars. Thus, one set of boxes is always out on the road while the other set is being emptied in the comptroller's office.

An empty box is given to each conductor when he starts on his run by the car starter at each depot, who enters on a properly ruled sheet, the conductor's badge number, the car number and the box number (each box bears a separate number). When the box is returned at the end of the run, the starter enters on the same sheet the number of trips made on the run and the number of trips lost, if any. This sheet is reproduced on the following page. It will be noticed it is divided into two divisions by a double rule down the center. The starter fills up the columns in the first division as just described, and at the end of the day the sheets are sent with the filled boxes to the comptroller's office for the additional entries, as shown in the second division, which are made as the boxes are opened and the contents counted.

As the boxes are turned in to the car starter's office at the ends of the runs, they are stacked in regular order by routes on special racks or trucks, shown in one of the illustrations. Similar trucks are used at all depots and in the comptroller's office for handling the boxes. Each truck holds about 200 boxes. The filled boxes are collected from each of the depots by two men, known as the box collectors, who use a special car fitted up for this work, and are delivered at the comptroller's office. At the end of each day, after the boxes have been opened and the contents counted by the accounting force (in the manner to be described), the empty boxes are replaced on the trucks, which are then run into a special vault in the comptroller's office, and the combination of the vault is locked.

The box collectors arrive at the office about 8 o'clock in the evening. They unlock the vault, draw out the trucks containing the empty boxes and arrange the boxes in regular order on the racks of the trucks to meet the requirements of the car starters at each of the five different car houses. They then place the empty boxes on the special car and deliver them to the starter's office at the different car houses ready for distribution to the individual conductors in the early morning. At the same time the collectors leave the empty boxes, they collect the boxes that have been filled during the day, and they take care to bring back a filled box for every empty they leave.

When the filled boxes are brought back to the comptroller's office they are assorted and placed in order of their run number and route on the trucks. When this work is completed the trucks are again run into the box vault, the doors are locked, and the trucks remain there until the cashier opens the vault in the morning and the clerks bring out the trucks. This is the regular routine for every night. The two collectors work from 8 o'clock in the evening till about 4:30 in the morning



TRUCK USED FOR HANDLING FARE BOXES, TORONTO RAILWAY

delivering the empty boxes, collecting the filled ones and arranging them on the trucks in the comptroller's office ready for the count in the morning.

When the accounting force arrives for the morning's work the boxes are opened by two clerks at a long table, and the tickets and cash contents are separated. The coins are passed to a cash counter and the tickets to the ticket counters. Owing to predominance of ticket fares on this road, one cash counter can keep pace with three ticket counters. This is not only due to the greater number of tickets, but also to the fact that each ticket clerk has to count and record under its proper column the number of each of the seven different classes of tickets that may be contained in the box given her. The contents of each box is, of course, kept separate during the count. The result of the count is then set down opposite the individual box number in the second division of the tally sheet previously mentioned. When the contents of the boxes for each route have been counted and entered on the sheet, the sheet is summed up, and we thus obtain the earnings of each particular route.

In this connection especial attention is directed to the fact

INSERTING COIN IN FARE BOX

INSERTING TICKET IN FARE BOX

that from this single tally sheet we obtain all the information necessary to determine the record for each day by each route of the number of cars run out, the number of trips run, car-mileage, car-hours, income per car, per car-mile and per car-hour, and in addition, it is used to check the number of hours of conductors and motormen recorded daily by the timekeeper.

At the present time we have three cash and nine ticket counters, and they are employed from 8:30 in the morning until 12:30 noon, counting the previous day's earnings, which average about $8,000 per day.

The cash counters count their cash but once, but this is checked by weighing first by themselves on a pair of apothecaries' scales and subsequently in the cashier's office by a finer pair of scales. The result is that the bank accepts our packages of silver without any hesitancy whatever.

When each route has been counted, the cashier's assistant collects the bags into which each of the ticket counters has deposited the tickets as counted. These are taken into the cashier's office with the cash counted on the same route. The packages of silver are checked by weight, and the individual bags of tickets are also checked by weight. We have found that our tickets vary very little in weight, and as a result of experiments we have arrived at the average weight per thousand tickets. We find we can check the count of tickets by weighing to an exactness of three places of decimals. Confirmatory experiments are conducted twice a week, so that we are prepared for any slight variation that may arise in the weight of 1000 tickets through a new issue of tickets being put out or on account of wet weather. The tickets having been weighed, the assistant, with the aid of a calculating machine, obtains the number of tickets in each bag as indicated by weight, and from the earnings clerk obtains the figures which the ticket counters have returned. It will be understood, of course, that the weight does not check the earnings, but only the total number of tickets. If the total number of ticket fares returned to the earnings clerk agree with the figures obtained by weight, we are able to obtain our earnings by multiplying the total of each class of tickets by its respective value and adding all together.

The entire day's receipts, both cash and tickets, remain in the cashier's care until after the cash has been weighed and checked, when the cash is taken to the bank and the tickets are taken to the basement and burned in a special ticket-destroying apparatus, which was described in the last issue of the STREET RAILWAY JOURNAL.

In conclusion, it may be said that the foregoing is a statement of the entire routine, and the entire office force engaged in handling, counting and checking our ticket and cash fares from the passenger to the bank or the furnace, and in determining our daily gross receipts, which now average approximately 1600 coins and 6400 tickets in seven different denominations.

19/10,000/9/05

Statement *for* ________________ *190*

________________ *Route*

	Badge No.	Car No.	Box Nos.		Trips per Card	Trips Lost	Trips Run	Cash Fares	Ticket Fares	Total Passengers	Conductor's Report

MOTORS		
No. of Cars run out		
Av. No. Cars		
No. of trips		
No. of miles		
Cents per mile		
Av. per Car		
FARES		AMOUNT
x 4 1/6 =		
x 4 =		
x 3 1/8 =		
x 3 4/7 =		
x 2 1/2 =		
x 4 =		
x 3 1/8 =		
TOTAL		
x 5 =		
TOTAL		
Employees Night Cars		
TOTAL		
TRAILERS		
No. of Cars run out		
Av. No. of Cars		
No. of trips		
No. of miles		
Cents per mile		
Av. per Car		
FARES		AMOUNT
x 4 1/6 =		
x 4 =		
x 3 1/8 =		
x 3 4/7 =		
x 2 1/2 =		
x 4 =		
x 3 1/8 =		
TOTAL		
x 5 =		
TOTAL		
Employees Night Cars		
TOTAL		
MOTORS AND TRAILERS		
Tickets		
Cash		
TOTAL		
Night Cars		
TOTAL		

DAILY TALLY SHEET, TORONTO RAILWAY

HANDLING FARES ON THE MONTREAL STREET RAILWAY

By H. E. Smith, Comptroller

The Montreal Street Railway Company has been using the fare box, or "coffee pot," as our friends in the States are pleased to term it, since the inception of the road, and we have found it a most excellent way of converging fares directly from passengers to the company.

In collecting fares, the conductor presents his box to passengers, who place their own fares therein. On no account is the conductor allowed to handle fares between passenger and box. The box is so constructed with a patent top that it is impossible to extract fares once put in, except in the legitimate way. When not in use, the box hangs on a hook just inside the rear entrance of the car, close to where the conductor stands. All our fare boxes, when purchased, are numbered on a small brass plate attached to the back of the box underneath the handle.

Every conductor that takes

out or relieves a car is given a box, the number of which is entered on a form (Fig. 1), together with badge number, run number and time out. This sheet is headed up with the name of the line, the day and date, balanced against the cash and handed over to the ticket counters at the sides of the table. The cash is then put up in envelopes of $1 and $5 each, weighed and handed to the cashier. The $1 envelopes are for sale to the conductors for change,

No. .... **MONTREAL STREET RAILWAY CO.** Sheet No. ....

Received at R.O. .... M. Earnings .... Line. Opened by ....

F. No. 41. .... day .... 190 Cash Counter ....

	Box No.	Badge No.	Run No.	TIME. Out	In	Employees' Tickets	FARES CASH 5c.	TICKET 4 1/6	4	3 1/8	Postmen 3 1/8	2 1/2	TOTAL	Comps.	
Total															

Checked by .... Out Clerk .... In Clerk ....

FIG. 1.—SHEET FOR KEEPING RECORDS OF FARE BOXES AND THEIR CONTENTS

and whether "regular," "relief" or "extra," separate sheets being used for each class. When boxes are returned, the "in time" is marked, and they are put up according to "streets" or "lines" and sent to the receiving office, where they are opened and the $5 envelopes are deposited in the bank. The total amount of each day's cash receipts, made up of cash fares, ticket sales, etc., are deposited in the bank on the following day by the cashier.

Mut. $ .... [F. No. 53]

MONTREAL STREET RAILWAY COMPANY.

SUMMARY OF EARNINGS, ... day, ... 190

Cash Counter .... From .... m. To .... m. Count No. ....

Employee	FARES. Cash 5c.	Tickets 4 1/6	4	3 1/8	Postmen, 3 1/8	2 1/2	TOTAL	Comps	Emp.	FARES. Cash 5c.	Tickets 4 1/6	4	3 1/8	Postmen, 3 1/8	2 1/2	TOTAL	Compr

FIG. 2.—FORM ON WHICH IS MADE UP SUMMARY OF EARNINGS FOR EACH DAY (INFORMATION TAKEN FROM FIG. 1)

and contents emptied on large tables. At the same time a clerk separates cash from ticket fares. The cash is counted at the ends of the table and tickets along the sides. As the cash is more quickly counted than tickets, the cash counter

The tickets as they are counted are dropped into paper bags, one of which stands at the side of each counter, and the totals of each class of tickets are entered on the statement in their respective columns. The statement is then totaled to show the number of each class of fares collected and the total fares col-

F. No. 51.

Montreal Street Railway Company.

SUMMARY OF EARNINGS .... *Line*

.... *day* 190

Sheet No.	FARES. Cash 5c.	Tickets 4 1/6	4	3 1/8	Postmen, 3 1/8	2 1/2	TOTAL	Comps

FIG. 3.—FORM FOR SHOWING TOTAL FARES ON EACH LINE (INFORMATION TAKEN FROM FIG. 1)

Montreal Street Railway Company.

Earnings for *190*

Line	FARES 5c.	Tickets 4 1/6c.	4c.	3 1/8c.	Postmen	2 1/2c.	Total Passengers	Night Car Earnings	Total Earnings	Comps Employees	Comps
Amherst.											
" Park & Boulevard											
Beaver Hall & Delorimier											

FIG. 4.—FORM FOR SHOWING FARES AND EARNINGS FOR ALL LINES (COMPILED FROM TOTALS ON SHEETS FIG. 3, AND TOTALS MUST BALANCE WITH TOTALS ON FIG. 2)

takes the sheet first, and as he finishes counting contents of each box, he enters the result in the column for that purpose opposite the box number. When the cash contents of all the boxes on the sheet have been counted, the sheet is totaled and

lected in each box. The bags of tickets are in turn sealed up in the presence of cash counter (a slip giving the number of tickets therein having been previously enclosed by each counter in his own bag) and placed in the cashier's vault, to be checked later by weight, and then sent to the power house and burned.

The totals of each class of fares, as shown on the form (Fig. 1), are then transferred to the form (Fig. 2), which represents the amount of cash and tickets counted, and from which the earnings for the day are compiled.

The forms (Fig. 1) are then assorted according to lines or streets and the totals transferred to the form (Fig. 3), using a separate sheet for each line, in order to show the total number of fares collected on each line.

The totals from these sheets are in turn transferred to the

MONTREAL STREET RAILWAY COMPANY (Form No 10

CARS AND TRIPS RUN .... day........ 190

ROUTE	Mileage per Round Trip	Schd Trips per Car	CARS Reg	CARS Extra	CARS Night	CARS Avg. per day	TRIPS Reg.	TRIPS Extra	TRIPS Night	TRIPS Total	MILES RUN Regular	MILES RUN Extra	MILES RUN Night	TOTAL
AMHERST,														
"														
"														
GUY, BEAVER HALL & DE[...]														

FIG. 5.—DAILY TRIP SHEET FROM SUPERINTENDENT'S OFFICE, GIVING OPERATING DATA FOR USE IN ACCOUNTING DEPARTMENT

balance sheet (Fig. 4) opposite their respective lines, values computed and the total earnings of all the lines balanced against earnings, as shown on the form (Fig. 2). From the information contained on the balance sheet (Fig. 4), and daily trip sheet from superintendent's department (Fig. 5), the daily comparative statement of earnings, etc. (Fig. 6), is compiled.

No. F. 70 **MONTREAL STREET RAILWAY COMPANY** Weather 190

Daily Comparison of Earnings, Etc., ... day, ... 190   190

LINE	CAR Reg.	CAR Ex.	CAR N.	CAR Total full Day	TRIPS Reg.	TRIPS Ex.	TRIPS N.	TRIPS Total	MILEAGE PER TRIP Reg.	MILEAGE PER TRIP Ex.	MILEAGE PER TRIP N.	MILES RUN REG.	MILES RUN Ex.	MILES RUN Night	MILES RUN TOTAL 190	MILES RUN TOTAL 190	CAR HOURS 190	CAR HOURS 190	TOTAL EARNINGS 190	TOTAL EARNINGS 190	EARNINGS PER MILE 190	EARNINGS PER MILE 190	EARNINGS PER CAR HOUR 190	EARNINGS PER CAR HOUR 190	PASSENGERS	TRANSFERS [APPROX.]
AMHERST.																										
SPECIAL CARS,																										
TOTAL, PREVIOUS YEAR,																										
INCREASE, DECREASE,																										

FIG. 6.—DAILY COMPARATIVE STATEMENT OF EARNINGS FOR ENTIRE SYSTEM BY LINES (MADE UP FROM FIGS. 4 AND 5)

City Treasurer Coady, of Toronto, has prepared a statement showing the city's percentage on the gross earnings of the Toronto Railway Company for last year and the preceding five years. The figures indicate the steady growth of the passenger traffic on the Toronto Railway, and as compared with the percentage of 1900, the city received over double the revenue last year. Mr. Coady also attaches a statement showing the gross earnings of the company and the city's percentage during December of last year, and for the same month during the five preceding years. An increase of over $9,000 has been made in six years. Following are the figures:

Year	Total Percentage
1905	$292,706.72
1904	249,511.42
1903	206,532.81
1902	165,172.69
1901	145,209.24
1900	127,128.10

FIGURES FOR DECEMBER

	Gross Receipts	Percentage
December, 1905	$243,764.78	$19,501.18
December, 1904	214,521.63	17,161.73
December, 1903	191,967.52	15,357.40
December, 1902	170,082.07	13,606.57
December, 1901	146,615.50	11,729.24
December, 1900	129,910.13	10,392.81

FARE COLLECTING*

BY D. McDONALD, M. I. E. E., Manager, Montreal Street Railway

The collection of fares is a very important and interesting subject, and too much cannot be said or written about it. If the same amount of deep thinking that is being constantly given to the less important technical questions should be devoted to the consideration of our modes of collecting fares, the results would, I am sure, prove marvellously profitable to most companies. After more than half a century's experience in operating of street cars, it must be admitted that our so-called systems of collecting are perhaps the most defective part of our organizations.

If the losses incurred yearly by the missing and purloining of fares could be computed with any degree of precision, the revelation would prove astounding to us all. This large and expensive "X" which managers agree to call 5, 10 or 15 per cent, amounts in most cases to a larger sum than most street railways pay in dividends, and the comparison presents itself still more strikingly when we consider that whatever part of this dead loss we can succeed in saving is not only an increase of earnings but a clear net benefit.

It is hardly necessary to go into the detailed enumeration of the different ways in which our "little grains of sand" are being gathered up to the present time. Their inherent defects are so patent and publicly known that any one of our patrons, so disposed, can relate to us precise information about them, without, however, being able to suggest any effective remedy for the evil. Therefore, to save time, I will limit myself to a short mention of the different systems that you all know so well, just to help us face this difficult question in the proper manner.

First—The Register: On this Continent the register seems to have proved the most acceptable to American companies, who are far from being satisfied with its elastic guarantee. The exhaustive reports of our secret service reveal too clearly how often it is beaten and tampered with, to enable us to recommend it as anything like an ideal system, and the missing of fares, especially in crowded cars, is not diminished by its operation, although it must be said that outside of rush hours its automatic figuring does assist the conductor, to a certain extent, to keep tab on new arrivals. Owing to the increase in the use of tickets in the United States, the register is daily becoming less satisfactory. The register is, however, accepted and tolerated for want of a better method.

Second—Fare Boxes: The portable fare box (carried by conductors) is generally adopted on the Canadian side of the line, and the best argument in its favor is, perhaps, that the fare receipts, by the use of this box, are prevented to a great extent from straying into the pocket of a third party and go direct from the patron's hand to the company's office, which is a considerable advantage. Another point in favor of the box

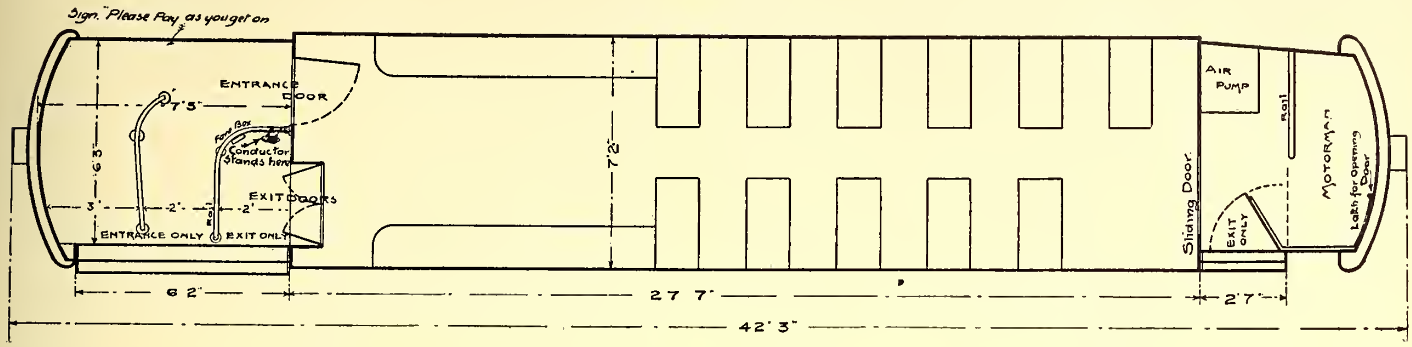
* A paper read before a meeting of the Canadian Street Railway Association, held at St. Catharines, Ont., Dec. 14 and 15, 1905.

is that the fare must be deposited in the box by the passenger, and if this is not done the patron is immediately made aware of the fact that the conductor has failed in his duty. As to preventing the missing of fares, it cannot be said that the box system is any more effective in this respect than the register.

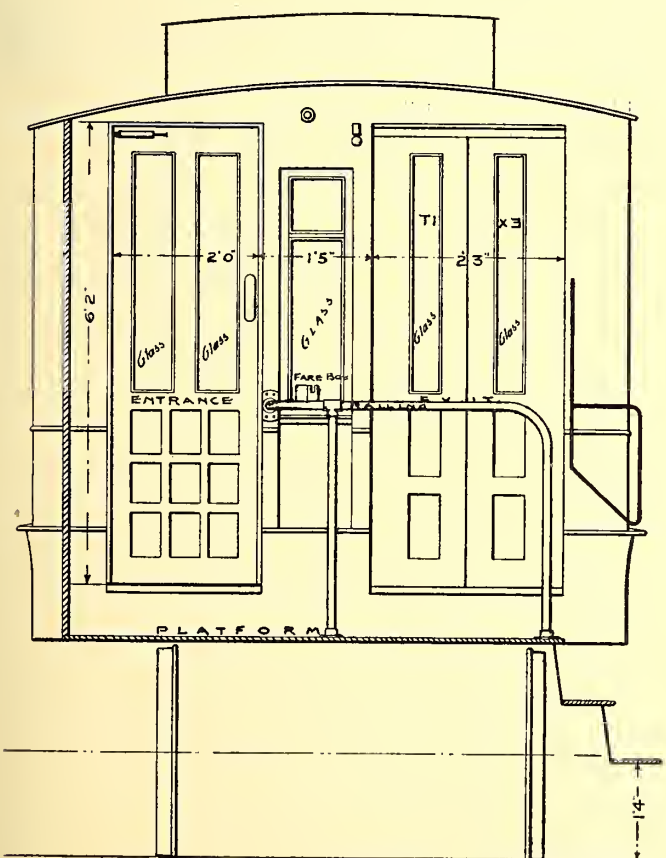
Third—Receipt System: The European system of giving a receipt to each passenger for his fare and having inspectors to control the issue of said receipts, is another mode of collecting which has only met with partial success for many reasons. The fact that the inspector can only check a small portion of the receipts issued renders it very undesirable, and the complete checking of all receipts, which would require a very large number of inspectors, would only lead to a greater difficulty, likely to a mutual understanding between careless inspectors and conductors, which would prove equally disastrous. The reissuing of receipts already used and the difficulty of preventing this abuse is another great defect in this system.

The writer has had considerable experience in the general working of the receipt system on a large number of European roads, and is of the opinion that this mode of collecting is fairly adaptable to long suburban or interurban runs, but in city service it is very much disliked by passengers who protest against being disturbed or annoyed on short trips to produce their receipts for inspection. Again, the missing of fares is not safeguarded by the use of this system, and the failures to collect in rush traffic are just as numerous as with our American systems.

Fourth—Prize Systems: The system of giving prizes to be drawn for by holders of receipt coupons is claimed to be an improvement on the receipt system, but even if this lottery business could be legally practiced in our country, it would only partially protect against the losses above mentioned.



PLAN OF MONTREAL "PAY-AS-YOU-ENTER" CAR, SHOWING ARRANGEMENT OF PLATFORMS AND SEATS



END SECTION "PAY-AS-YOU-ENTER" CAR

These three or four different ways of collecting are the most in vogue, and we are forced to admit that they are, one and all, essentially deficient. Each and every one of them imposes a well-nigh impossible task on the conductor, who by these methods cannot be strictly held to the integral collection of all his fares. Twenty-five people enter a car and pay their fare, twenty-five more are taken on in the next few blocks, and after they have been well mingled and mixed up with those who have already paid, the poor conductor is expected to go and pick them out without missing any; a very difficult task which must, perforce, be only partly accomplished.

The above facts have forced us to the conclusion that our modes of collecting up to recently are unbusinesslike and impractical, and that to improve them we must furnish our conductors with some systematic means of following this collection of fares and prevent that doubtful and groping sentiment that places them now at the mercy of forgetful or ill-disposed passengers.

The only ideal system of collecting in vogue to-day is the positive system, as it is worked on subways and elevated railways, where passengers have to pay before entering the car on which they desire to travel. We are all thoroughly convinced that the application of this system to our surface operation, if it were practicable, would be a source of great benefit, and we would immediately cease to have tribulations on this subject. Unfortunately, it is not possible to adopt this method integrally on surface cars, but we are persuaded that the best means of improving our fare collection is to adopt the elevated system, in so far as possible.

With this idea in view, we are at present experimenting with a new make of car in Montreal, that permits of the application of a very positive mode of collecting, the nearest approach to the exemplary system above mentioned. These new cars, known as the "Pay as you enter cars," have been in operation for several months and are giving good results. Our comparative statement shows that earnings on this style of car are much higher than on other cars where collecting is done in the old way The new car has in place of a 5-ft. platform, one of 7 ft., and instead of the ordinary door placed in the center of the end there are two doors, the brass railing leading up from the steps dividing the platform into two aisles. The door to the left is to be utilized by persons entering the car and the other solely by those who desire to leave. This is arranged and made arbitrary by the fact that while one of these doors opens inwardly only, the other opens only outward. When a passenger steps on the platform, which is amply large for thirty adults, he is met by the conductor who requests a

REAR PLATFORM OF "PAY-AS-YOU-ENTER" CAR, SHOWING POSITION OF CONDUCTOR AND PASSENGER WHEN PAYING FARE

fare before the passenger enters; in other words, the platform is the pay office on the car. The passenger then passes on through the entrance door into the car, from which he may

INTERIOR "PAY-AS-YOU-ENTER" CAR, SHOWING ARRANGEMENT OF SEATS; ALSO EXPERIMENTAL FLOOR OF RUBBER TILING

make his exit at any time, either by the front entrance or by the rear door designed for the purpose.

The conductor having no fares to collect from passengers in the car, can remain at his post on the platform, giving such attention as is necessary to the passengers getting on or off the car. The conductor is also provided with a receptacle into which the fare box fits, so that he may when necessary have both hands free and at the same time not miss fares. As these cars are all provided with electric buttons as well as the usual

REAR PLATFORM OF "PAY-AS-YOU-ENTER" CAR, SHOWING EXIT AND ENTRANCE PASSAGEWAYS

signal cord, the passenger can easily and at all times make his desires known without having the conductor at his elbow.

Another improvement in the new design is the exit from the front platform. This portion of the car being more spacious than usual, not only gives the motorman ample room, but he is also divided from the rear portion of his platform by a brass railing. At the motorman's foot is a catch which when released by pressure throws open the door automatically, thus making it unnecessary for the man in charge of the motors to even raise his hand or turn his head.

In view of the fact that serious accidents on street cars happen at the back platform when the conductor is busy collecting fares inside the car and unable to properly gage stops and starts, the new design is considered most important.

The saving of time is also a great advantage, as passengers begin to enter immediately the car stops, without having to wait for passengers getting off. The moment intending passengers are all safely landed on the platform the car is started, and in a few seconds after this fares are all collected before reaching the next stop.

A large number is painted on the front dash of the car so as to indicate to intending passengers, who can see it blocks away, that a new style of car is coming, or "Get your fare ready, please," and it is pleasing to note how quickly they do prepare and how quickly the ten, fifteen or twenty passengers can pay their fare and be served with transfers with this system.

We are of the opinion that to improve our mode of collecting fares and save our losses, a radical departure must be made from the old method, and we must, by the adoption of a positive businesslike system such as prevails in all other lines of transportation and regular business, get the best hold possible on our well-earned receipts, for, if we do say it ourselves, "We deliver the goods every time," and where can you get better value for your money?

In connection with Mr. McDonald's paper are presented several illustrations which explain the details of the platform and interior arrangements on the new "pay-as-you-enter car." In conjunction with some of the new types of cars the Montreal Street Railway Company is trying the experiment of using rubber tiling for the car floor. This tiling is a special composition of rubber, vulcanized to a certain degree of firmness, sufficient to give slightly to the pressure of the foot. The tiling is made in the shape of male and female interlocking Maltese crosses of various colors, and gives promise of affording a non-slipping, cleanly and durable flooring. The tile is made by the Gutta Percha & Rubber Manufacturing Company, of Toronto, Montreal and New York.

PRESENT RAIL-JOINT PRACTICE IN GERMANY

At the tenth annual meeting of the Verein-Deutcher-Strassenbahn-und-Kleinbahn-Verwaltungen (German Street and Interurban Railway Association), Arthur Busse, ober-ingenieur of the Grosse Berliner Strassenbahn, presented a summary of German rail-joint practice derived from the reports of 119 railways.

It appears that in service which does not require heavy cars operating on frequent headway, and where a hand brake satisfies normal braking conditions, the ordinary angle-plate joint is still satisfactory. However, where heavy rolling stock is used and there is considerable vehicular traffic, some special form of rail-joint is necessary. Quite a number of railways are using 15-m (49-ft.) rails, and the rail mills have been requested, though without success, to quote on 18-m (about 58-ft.) rails. Opposite joints have been used to some extent, but have not proved satisfactory, owing to the tetering of the car when the joints get low.

When laying new track, it is the almost universal custom in Germany to smooth off, by filing or milling, the heads of the rails near the joints after making the joints. It is desirable to repeat this after the track has been in use for a week or two, because at the end of this time slight inequalities develop, which should be removed promptly. It is also a common practice to machine the rails when making angle-plate joints, so as to secure a good fit.

No one type of joint is best for all conditions. Among those which have proved very satisfactory is the Melaun rail-joint, which was described in the Street Railway Journal of June 25, 1904. This joint is especially desirable for use in asphalt paving on account of the minimum disturbance which it requires in the paving. Berlin is the only place where this joint has been in use for any considerable length of time (since 1901) under exceptionally severe conditions on lines with 28-second to 60-second headway. The makers of this joint guarantee to keep it in perfect condition for four years, no matter how severe the service may be. The Grosse Berliner Strassenbahn has installed a large number of Melaun joints on old track where the original Falk cast-iron joints had to be replaced. At first it was feared that the top piece of the joint would not wear at the same rate as the adjoining rail heads, but thus far no irregularities of this kind have been discovered. For new track it is customary to specify that the top piece of the joint shall be of the same material as the adjoining rails. The joint has also been successfully applied to broken rails and to rails with low joints without disturbing the rest of the track. About 25 minutes are required to mill the rail ends for the reception of the joint, and 35 minutes more for the complete installation. The cost of the current consumed by the milling machine is about 6 cents, figuring power at 2.25 cents per kw-hour.

Three German roads have employed Falk cast-welded joints, namely, Breslau, Cologne and Berlin. The two first are well satisfied, and the Cologne management reports that of 750 joints only one was ruptured in the winter and that one rail cracked for a distance of 40 cm (about 16 ins.) from the welding point. Experiments made on the broken rail showed that the welding temperature had not changed the nature of the material. The welded joints, however, do not give perfect riding. The Grosse Berliner Strassenbahn has installed over 10,000 cast-welded joints, but they have not given the desired results. They were first applied to old grooved rails on which the original joints had worn out. Although this prolonged the life of the rails for several years, it would have been cheaper to have installed ordinary angle plates which would have given the same life. Applied to new rails, the Falk joint has not been able to prevent low joints nor the rails from working loose. It has also unfavorably influenced track repair maintenance.

The Goldschmidt thermit process has also been adopted by a considerable number of German railways. In Berlin, where the work was carefully done, the thermit joint has shown no defects whatever under most severe service.

A new electric welding process has been introduced by the Akkumulatorfabrik A.-G., Hagen-Berlin. Instead of using the alternating-current resistance method, employed in the United States and England, heat is secured by the formation of an arc between the rail and a carbon electrode. The welding apparatus is contained in two cars, one holding the storage battery and the other a motor-generator set for reducing the trolley voltage to 60 volts. The Hagen Street Railway, which was the first to use this method, thinks very favorably of it. The Grosse Berliner Strassenbahn has also tried it for 100 joints, some with soft material and others with hard material for the connections. Joints made with the former soon showed signs of wear, but the latter are giving good service under severe conditions.

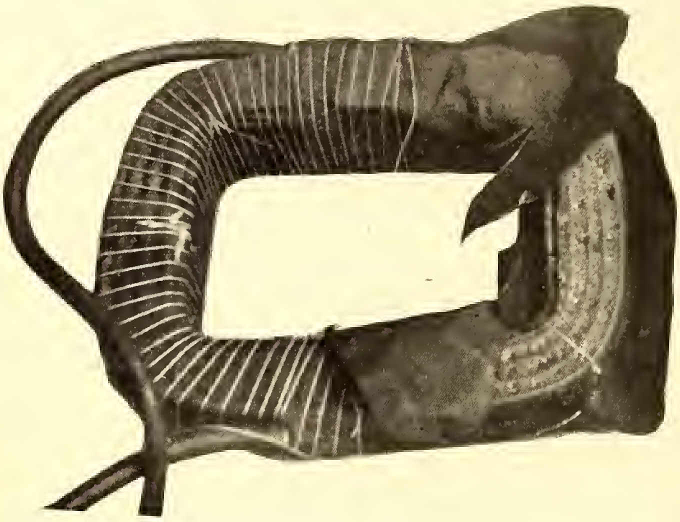
In conclusion, the report states that the wear of joints is less on a single than on double track, because on single-track roads the traffic is equal in both directions, so that the joints wear down more evenly than on double-track lines where the traffic moves in one direction. Single-truck cars are more injurious to joints than double-truck cars. On up grades the joint wear is less than on down grades or level track. As to the effect of sanding, observations show that if applied while braking, sanding does not tend to extra wear on the rails except in emergency stops, but the use of sand while running acts unfavorably on the rails and joints.

SINK HOLE CAUSES TROUBLE

The South Bend & Southern Michigan Railway has encountered more trouble at Hickory Creek. The huge culvert which has bridged Hickory Creek has given away and the company has sunk a few more hundreds of dollars in the hole. When the culvert was built the contractor said that it would never hold and was reluctant to build it according to the contract. His judgment has proved good, and the culvert is sinking. It has broken in the center and a gap of 2 ins. is apparent at the tip of the structure, while one of 8 ins. can be seen beneath. The culvert is almost 100 ft. long, and it was thought by the constructing engineers that it would support the fill which would have to be placed over it. The construction gang has run a temporary bridge over it and has been dumping earth on both sides in hopes of causing the earth to settle before they began to fill. The earth has settled under the center of the culvert and the middle of the great piece of work is sinking. The route will be changed to meet this new difficulty, the new one running through a neck of solid ground so that it will be possible to fill over the new culvert. It is said by engineers in charge that the work at Hickory Creek has cost the company $25,000 more up to the present time than the whole cost originally estimated.

REPAIR SHOP PRACTICES OF THE MONTREAL STREET RAILWAY

By gradual growth the shops of the Montreal Street Railway Company have come to include a complete car-building plant, an extensive machine shop and foundry in which the company



PARTIALLY COMPLETED FIELD COIL, SHOWING WRAPPINGS, MONTREAL STREET RAILWAY SHOPS

makes most of the supply parts required by the mechanical departments, and a well-equipped repair shop for making repairs to cars, trucks and electrical equipment. The plant as a whole is somewhat larger than is usually found in connection with roads of similar size in the United States, and this is explained by the fact that owing to its location the company has been thrown more or less upon its own resources in the matter of obtaining supplies, and has therefore gone into the work of manufacturing its own supply parts on a rather extensive scale.

This article deals particularly with some of the practices and devices in the company's repair shop.

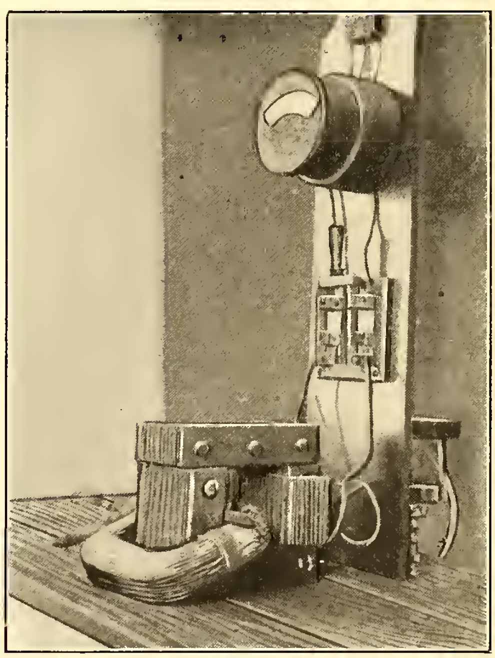
PREPARATION OF FIELD COILS

The conditions in Montreal are exceedingly severe on motor parts, especially in the spring, when the heavy snow that lies in the streets all winter begins to melt, and oftentimes it is necessary to operate cars for extended periods with several inches of water over the tracks. The necessity for using salt on the track in considerable quantities makes the situation all the harder on electrical equipment. To counteract these conditions, the master mechanic, Nelson Graburn, has been giving special attention to ways and means of fortifying fields and armatures against the excessive moisture, and has developed coils both for fields and armatures that are believed to be as nearly waterproof as human ingenuity can make them. The details may prove interesting to other master mechanics who are contending with similar conditions.

The process of preparing field coils is as follows:

The coils are formed of triple cotton-covered wire, which is wound to form on an ordinary lathe. After the coil is wound, and before any insulating compound is applied, it is placed in an electrically-heated oven and kept in a temperature of 195 degs. F. for 5 hours. While still hot from the oven, the coil is immediately submerged in a tank of armalac compound for 5 hours. It is then taken from the tank, replaced in the oven and baked for about 2½ hours at a temperature of 195 degs. After this baking, the coil is covered with two pieces of 8-oz. canvas duck, the canvas having been previously dipped in compound and baked for 2½ hours. The two layers of duck are cut on a form and are wrapped around the coil, one on the top and one on the bottom, the two layers overlapping each other by about 1¾ ins., so that even if the field is submerged in water to three-quarters of its thickness there is no joint in the canvas wrappings for the moisture to penetrate. The canvas covers are bound in place with asbestos string. After the coil has been wrapped with the compound-soaked duck it is again placed in the oven and kept at a temperature of 195 degs. for 2½ hours, after which it is immediately submerged in the compound tank for 2 hours, and is then again baked in the oven for 2½ hours at the same temperature. The coil is then returned to the winding room and is reinsulated with coarse linen tape 1 in. wide. After the wrappings of tape have been applied, the coil is sent to the oven for another baking of 2½ hours at 195 degs. and is resubmerged in the compound tank. It is then returned to the winding room for a second braiding of tape, after which it is submerged in compound and finished with a heavy coating of asphaltum paint.

DIPPING FIELD COILS, MONTREAL STREET RAILWAY SHOPS

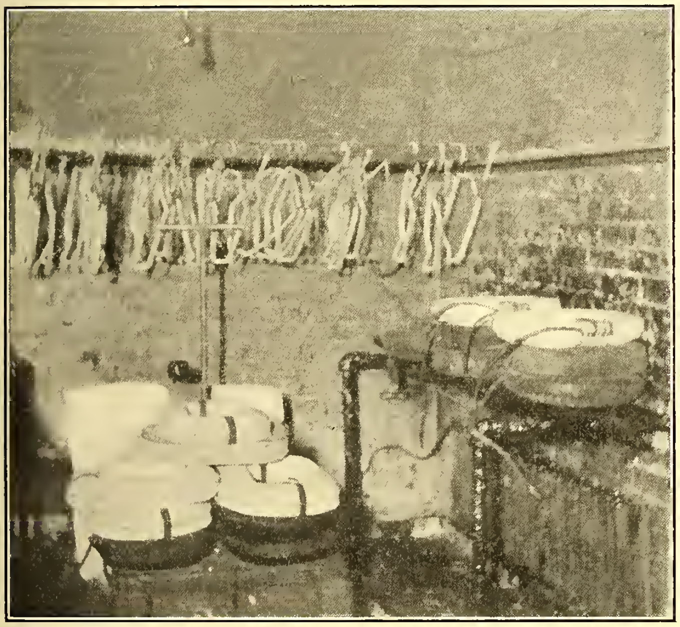


TRANSFORMER DEVICE FOR TESTING FIELD COILS, MONTREAL STREET RAILWAY SHOPS

REMOVING COMMUTATOR COLLAR, MONTREAL STREET RAILWAY SHOPS

It will be noticed that the process includes more frequent bakings and dippings than are usually considered necessary, but the experience in Montreal has been that each step of this process is fully justified by the greatly increased moisture-resisting qualities obtained in the completed coil. A point worthy of notice is that after repeated experiment and comparison it has been found that conspicuously better results have been obtained by drying out the coil in the oven in each instance before the submersion in the compound, as the coverings of cotton and canvas appear to absorb the compound more thoroughly if the compound is applied while the wrappings are still hot. The repeated heatings also serve to drive out all moisture at each step in the process of manufacturing the coil, so that when the final coat of asphaltum paint is applied there is absolutely no internal moisture between the wrappings of wire or between the individual coats of varnish.

Summed up, it may be said that the successive dippings have the effect of thoroughly impregnating the cotton and canvas coverings with the compound, and the bakings serve not only to drive out all moisture but also to harden the different coatings, the process as a whole tending to give a coil that is as nearly a hard homogeneous waterproof mass throughout its entirety as it is possible to obtain. In proof of the efficacy of the process, it may be stated that since its introduction the number of fields sent to the shops for repair has decreased 75 per cent, and in conjunction with the method of treating armature coils has resulted in a reduction of about $1,000 per month in maintenance of electrical equipment.



INTERIOR ELECTRICALLY HEATED BAKE OVEN, MONTREAL STREET RAILWAY SHOPS

At first thought, it might be assumed that the somewhat lengthy process of preparing field coils as outlined would materially increase the cost of manufacturing the coils. As a matter of fact, the actual cost of turning out a completed coil has been considerably reduced. This is explained by the use of cheap cotton tape at 10 cents a yard as a substitute for rubber or other expensive makes of prepared tape which cost from 25 cents to 35 cents a yard. In proof of this reduction, the following statement is taken from the shop records:

COST OF MATERIAL FOR INSULATING FIELD COIL OF GE 1000 OR GE 67 TYPE BY OLD PROCESS

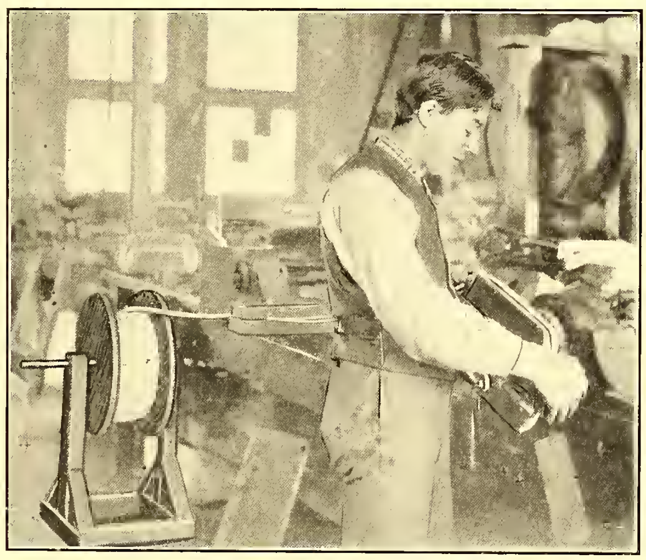
2½ lbs. rubber friction tape at 27 cents a pound (about 1 yd. to a pound)	$0.68
1-6 gross 1¼-in. cotton tape at $1.50 a gross	.25
½ yd. .005-in. brown paper at 12 cents a pound	.06
Total	$0.99

COST OF MATERIAL FOR INSULATING SIMILAR COIL BY NEW PROCESS

1-6 gross 1¼-in. cotton tape at $1.50 a gross	$0.25
1 yd. 8-oz. canvas duck	.10
Half ball twine	.05
Total	$0.40

For the two processes, the cost of the wire, compound and labor will be practically the same. It may be that if the successive bakings and dippings are carried out as outlined that the cost of labor will be slightly higher for the new process, but even allowing for any additional labor and other expenses incidental to the new method, a far superior coil can be produced for not to exceed half the cost of the more common process, providing, of course, cotton tape is used in place of rubber.

At a recent test, a field coil prepared according to the new method described was submerged in water containing 5 per cent salt for six weeks, during which time it was subjected to a constant current of 150 amps. at 500 volts, and the coil then measured 4000 ohms on insulation test. It may be stated that the process is applied in the Montreal shops to the manufacture of coils for some eight or ten different types of motors, including most of the older and modern types of Westinghouse and General Electric apparatus.



WINDING ARMATURE COILS, MONTREAL STREET RAILWAY SHOPS

TESTING FIELD COILS

When a field coil is received at the shops for repair, it is the practice to first test it to see if it is fit for repair. For making this test, and also for testing completed field coils, a homemade device is used. This consists of a laminated core made in the form of an inverted horseshoe, with a movable laminated section to bridge over the two ends of the shoe. The coil to be tested is placed over one leg of the shoe and the removable laminated section is placed in position, the horseshoe with the adjustable bridge thus forming the primary and the field coil to be tested the secondary of a static transformer. An alternating current at 52 volts (obtained from a 1000-volt lighting circuit through a step-down transformer) is then passed through the device and the condition of the coil is read on an alternating-current ammeter.

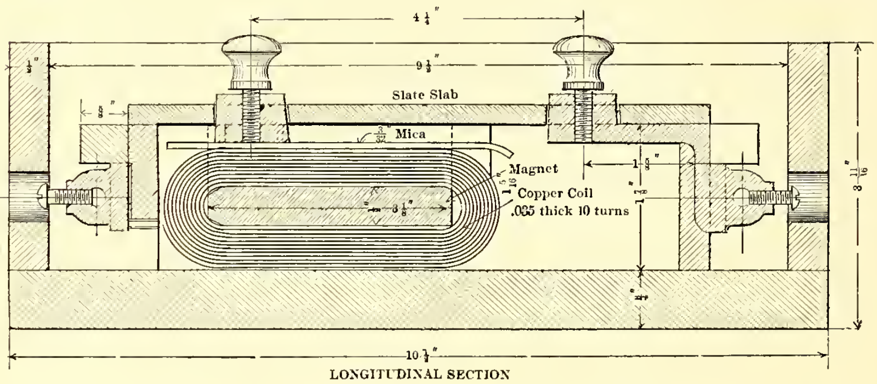
It has been the experience at Montreal that it is uneconomical as well as unsatisfactory to attempt to retape old field-coil wire in the effort to make new coils from old wire. In the first place, it has been found practically impossible to properly clean all the old insulation from the wire, and in the second place it is next to impossible to retape the old wire in a satisfactory manner. Coils that were made a few months ago from old wire on this road are now coming into the shop with the insulation all through the coil practically ground into dust. When the turns of wire are separated, this old insulation can be easily stripped from the wire with the fingers. Mr. Graburn

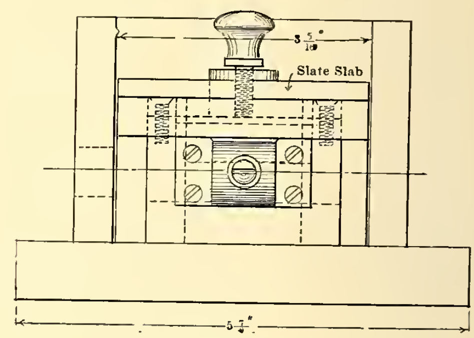
TRANSFORMER FOR TESTING ARMATURES, MONTREAL STREET RAILWAY SHOPS

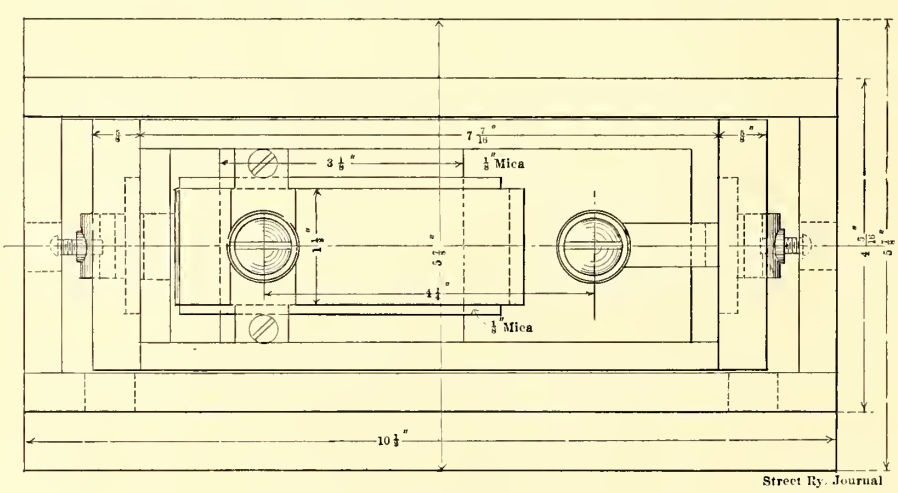
HANDY AIR-GAS FURNACE, MONTREAL STREET RAILWAY SHOPS

draws the conclusion that tape cannot be applied to the old wire with any degree of success.

Moreover, aside from the quality of the coil after it is finished, it is held that at the Montreal shops at least it costs







DETAILS OF FUSE BOX, MONTREAL STREET RAILWAY

more to make a field coil from wire that has been previously used than it does to buy new wire throughout. In support of this it is pointed out that the present scrap value of copper is about 16½ cents per pound, and new cotton-covered wire can be purchased for 19 cents per pound. Leaving out of consideration the labor item, this works out as follows: Taking the cost of new cotton-covered wire at 19 cents per pound, and allowing 54 lbs. to a coil, the cost of material for forming a coil from new wire will be $10.26. Taking the scrap value of copper wire at 16½ cents, the value of the copper in an old coil will be $8.91, but in comparing the two processes, it is necessary to add to this latter figure the cost of 4 lbs. of tape at 90 cents a pound, or $3.60, making a total of $12.51 as the value of material in a coil formed from old wire. This gives a balance of $2.25 on material alone in favor of scrapping the old coils and buying new covered wire for making new coils. Of course, this calculation hinges entirely on the relative values of copper wire when new and as scrap.

ARMATURE COILS

The process followed in winding coils for armatures is as follows: The coils are formed of triple-covered cotton wire on forms in the usual manner. After the coil is formed, it is baked in the oven at a temperature of 195 degs. F., and while hot is submerged in armalac for 2 hours, after which it is returned to the oven and baked for 2 hours longer at the same temperature. The coil is then given one wrapping of "linotape" and an outside covering of cotton tape, and the process of baking for 5 hours, submerging in the compound for 2 hours, and baking again for 2 hours is repeated. The use of rubber tape in making armature coils has been entirely abandoned.

TESTING ARMATURES

For determining the electrical condition of armatures, both before and after they are repaired, a simple home-made transformer is used. As will be observed from one of the illustrations, this consists of a laminated frame built in the shape of a right angle, this form making it convenient to receive the armature. By means of detachable flexible leads, the transformer is used in conjunction with the same ammeter that is employed for testing field coils, as previously described.

COMMUTATORS

The company is now making all of its own commutators from rolled bar copper, and Mr. Graburn states it has been his experience that a rolled commutator bar is fully 30 per cent tougher than a drop-forged bar, and the life is proportionately greater. The copper is purchased in long bars and is sawed to proper lengths. These pieces are then formed into commutators by means of adjustable rings with the mica separators in place. The partly finished commutator is then sent to a lathe and the notches are machined out to fit the commutator body.

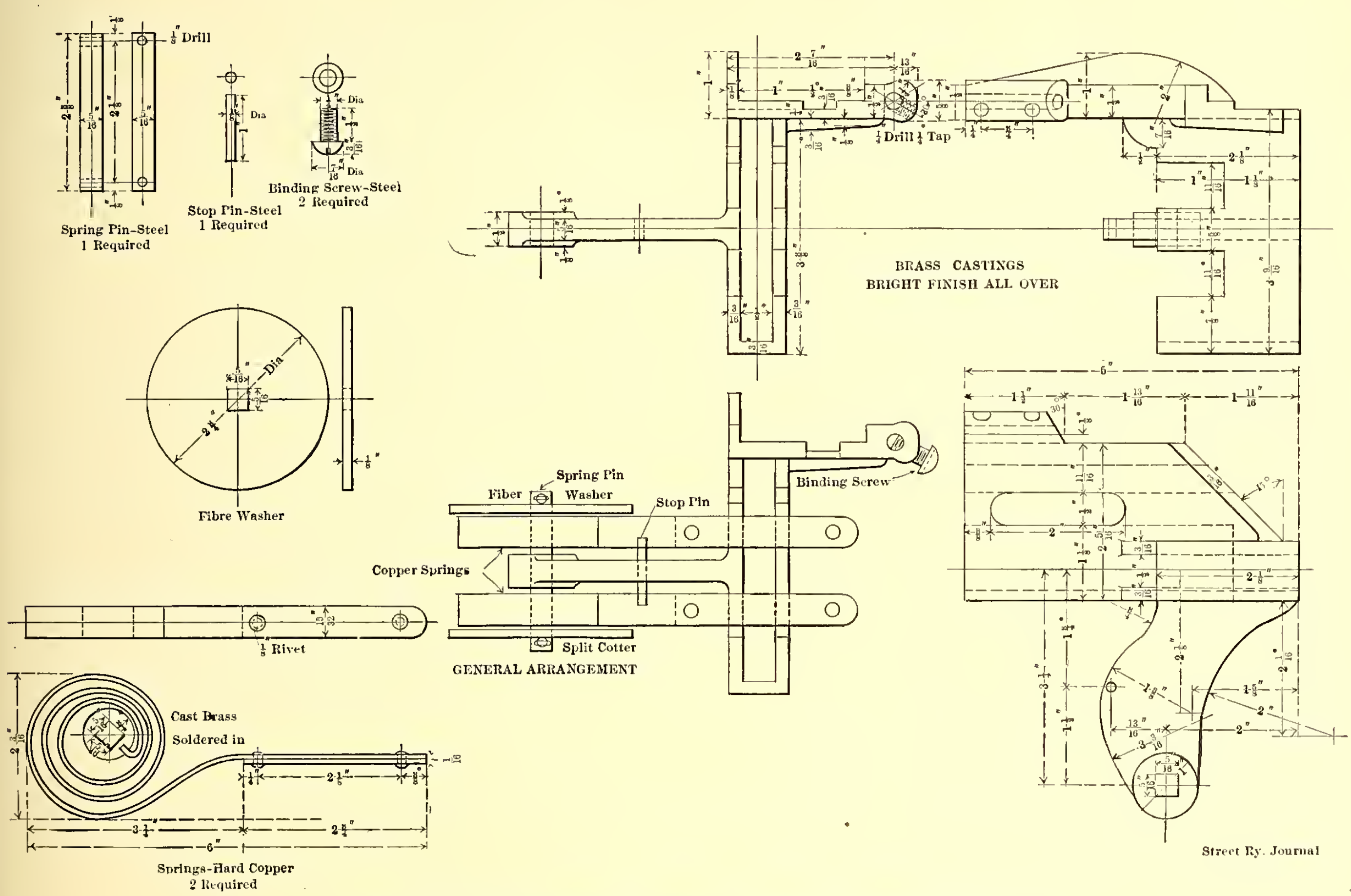
There is in use in these shops a special device for making quick repairs to commutators that come in from service with defective bars. This consists of an iron standard bolted to the floor and having a recess to receive the end of an armature shaft. The armature shaft with armature, commutator and pinion in place is stood on end in the recess and is keyed in place so that it cannot revolve. By means of a heavy two-handled wrench, with handles about 8 ft. long, the commutator ring is then screwed off, thereby loosening the commutator so that one of the mica separators or a low bar or a short-circuited bar can be renewed without disconnecting the other commutator connections from the armature. Before the commutator ring is screwed off, a ring made of wire is slipped down over the commutator and turned up tight so that the commutator bars cannot separate from the core. By making a sharp bend in this wire ring, the defective bar or mica segment can be drawn out and replaced without disturbing the other bars or segments. When the defective section has been repaired, the commutator ring is again screwed on by means of the long wrench and the armature is sent to the lathe for turning down the commutator. This device, which is illustrated on page 144, gives facilities for repairing defective commutators without going to the expense of removing the entire commutator or the armature from the shaft.

AIR-GAS FURNACE

A convenient appliance in these shops is an inexpensive air-gas furnace for heating soldering tools and for other small work. As will be seen from the engraving on the preceding page, this consists of a small retort built up of loosely laid fire-brick, the whole resting upon a cast-iron pedestal. An ordinary combined gas and air-blow torch is mounted at the rear of the retort and furnishes a quick intense heat for a variety of uses.

CONTROLLERS

Like other roads, the Montreal Street Railway has had its share of controller troubles, but has now succeeded in practically eliminating the expense of burnt out controllers by the generous use of asbestos lumber inside the controller case. A deflecting shield of asbestos ¼ in. thick is fitted between the main and reverse cylinder to prevent arcing over. The separators between the fingers are also made of asbestos lumber in place of the fibre formerly used. An important improvement has been made by lining the cover and the back of the controller case with ¼-in. asbestos lumber, and this lining has effectually eliminated trouble caused by arcs jumping from the cylinder to the controller case. One of the photographs reproduced on the following page serves to illustrate the difference between an unlined and a lined controller case. The case shown at the right hand of the picture represents the typical condition in which a controller comes to the shops after a blow-out. Not only has the asbestos lining cut down the expense of repairing controllers, but it has also practically eliminated accident claims for damages caused by flames from arcs burning holes in the controller cases and injuring passengers and property. The use of asbestos in this connection is also extended to the reversing cylinder, and the cylinder is made entirely of asbestos lumber. The reversing contacts are imbedded in asbestos, and there is also a deflecting shield of the same material on the top and bottom to prevent the arc from jumping to the frame in cases when the motorman attempts to reverse his motors. The company punches all its own controller parts from flat copper bars.



PARTS OF MOTOR BRUSH HOLDER, MONTREAL STREET RAILWAY

FUSE BOX

The fuse box used by the company is shown in drawings on page 146. The feature of the box is in the increased distance between the terminals. The style of box formerly used had only a 2-in. space between the terminals, and a considerable number of boxes were destroyed by reason of arcs jumping across the terminals. With the increased air space this trouble is now avoided. Since the drawing of the fuse box reproduced herewith was made, the company has tried, with good results, the experiment of substituting asbestos lumber for the slate slab on top of the box, and all fuse boxes are now made with asbestos tops.

BABBITT BEARINGS

In motor bearings the company is using babbitt made from the German Navy formula, as follows:

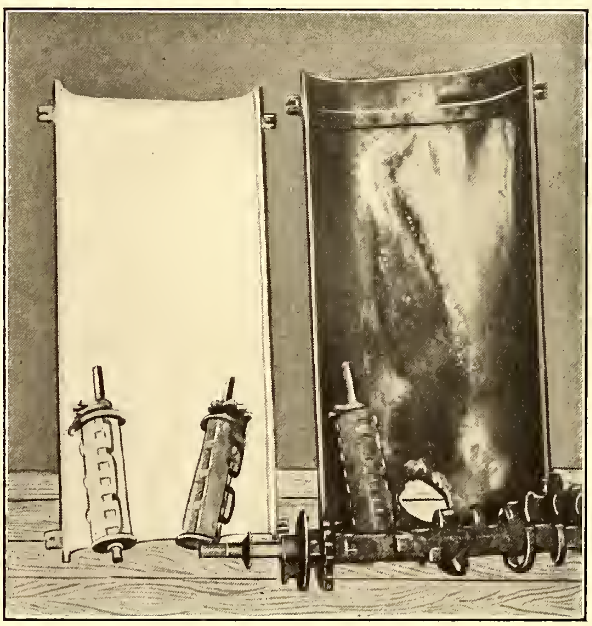
	Per Cent.
Tin	16
Copper	5
Zinc	79
Antimony	..
Lead	..
	100

This is the formula used by the German Navy in engine and gun bearings. With the composition, the Montreal Street Railway Company is getting from 60,000 miles to 70,000 miles out of armature bearings.

NOVEL BRUSH HOLDER

The company has formerly had considerable trouble with motor brush holders. To remedy the defects, and also to secure a holder that would give better facilities for replacing the carbon brushes, Mr. Dubie, foreman of the machine shop, devised the holder illustrated on the preceding page. In this device the carbons are mounted in grooves and are held against the commutator by two spiral springs made of phosphor bronze strips, the ends of which press against the tops of the carbons and exert a constant and even downward pressure. On the outside of each spiral is a fibre washer, designed to prevent short-circuits between the brush holders and the motor frame.

A feature of the device is the rapidity with which the carbon brushes can be examined and renewed when worn out. By merely lifting the end of the spring with one finger, the carbon is exposed and can be readily lifted from its groove. If it is desired to hold the ends of the springs back away from the carbons for any length of time, as during inspection or when renewing brushes, the ends of the springs can be made to engage small stop pins which are attached to the shank of the holder, as may be understood by reference to the drawing. This type of brush holder is adaptable to GE 67, GE 1000 and GE 800 motors.



CONTROLLER CASE LINED WITH ASBESTOS, AND UNLINED CASE, SHOWING EFFECTS OF BLOW-OUT, MONTREAL STREET RAILWAY SHOPS

STRAIGHTENING BENT AXLES AT ROCKFORD, ILL.

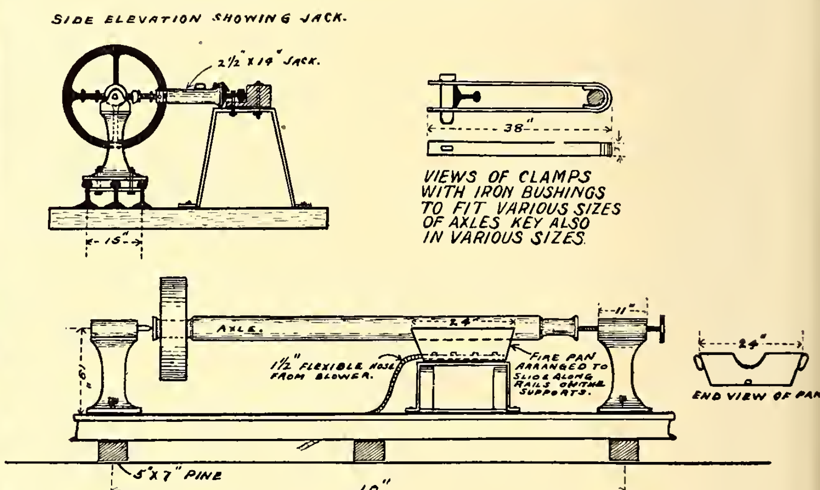
What seems to be a very handy and practical device for straightening steel and iron axles has been constructed by the Rockford & Interurban Railway Company, of Rockford, Ill. It consists principally of an ordinary 2½-in. x 14-in. screw jack arranged to slide horizontally, by means of a large hook, along a 12-ft. section of 70-lb. T-rail laid flatwise on two supports of ½-in. x 3-in. bar iron or steel. The axle is held in place parallel to the rail and at the same height by two lathe heads which are securely fastened to three 12-ft. sections of rail set upright. Then by pressure of the jack against the bent portion, the axle is straightened.

For the purpose of truing the axle, a two-piece wooden pulley is fastened to the journal (which with leather bushings is adapted to the various sizes of journals), and by throwing on the belt connecting the regular shop shaft, the axle is revolved and chalked at the proper point.

To resist the pressure of the jack, suitable and adjustable clamps of ½-in. x 3-in. bar iron or steel are placed each side of the bent portion and secured to the rail with various sizes of keys in a slot. By the use of various sizes of metal bushings the clamps are adjustable to any size axle or portion of the axle.

For hammered iron axles the part to be straightened is heated to a red-hot degree by means of a coke fire made in a pan about 2 ft. square, which is movable and arranged to slide on the support of ½-in. x 3-in. material along the rails supporting the lathe heads. A 12-in. blower supplies the necessary draft through a 1½-in. flexible pipe which is attached to the fire pan at one end, and the air is admitted to the fire at the bottom of the pan through small apertures at equal distances of about 3 ins. Coke is used to prevent smoke in the shops.

Acknowledgment is due for this information to Samuel DeCamp, master mechanic, who designed this device.



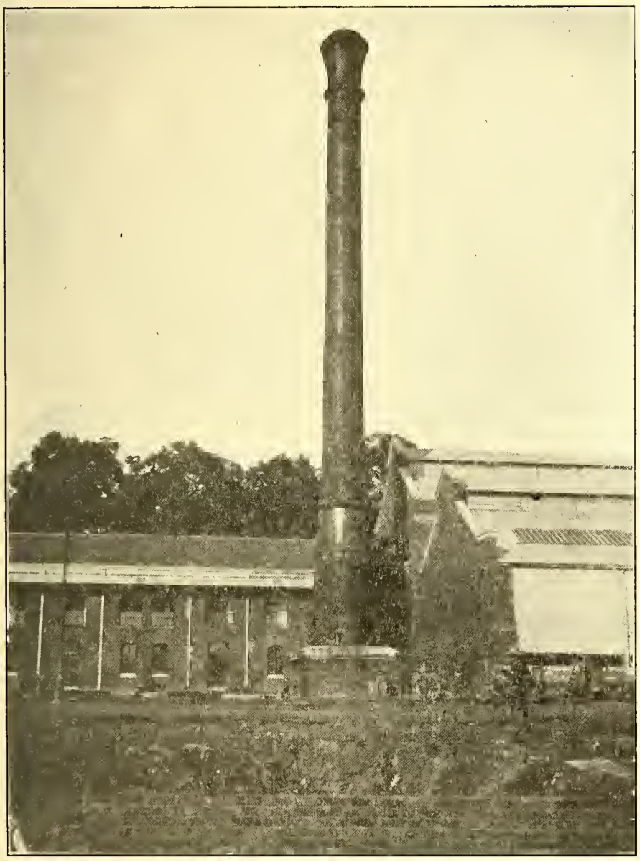
WORKING DRAWING, SHOWING CONSTRUCTION DETAILS OF MACHINE FOR STRAIGHTENING BENT AXLES

With the beginning of the new year the Jackson & Battle Creek Traction Company began running through freight cars from Kalamazoo to Jackson. Heretofore all merchandise had to be transferred at Battle Creek.

ELECTRIC TRAMWAYS IN SINGAPORE

With the exception perhaps of the thriving tramway enterprise in Calcutta, described in the STREET RAILWAY JOURNAL for April 29, 1905, the newly-equipped electric tramways in Singapore may safely be said to be the largest and most up-to-date system east of Suez.

The buildings in Singapore, like those of other places in the Far East, range from substantial brick and stone structures to the rudely made huts of the native Malays. From the illustrations shown herewith it will be seen that the streets are for the most part broad, straight and level, thus being admirably adapted for electric tramways. The total population is approximately 250,000, which, besides Europeans, includes Eurasians, Chinese, Malays, Indians, Japanese and many other nations and races.



EXTERIOR OF STATION, SHOWING STACK

The climate of Singapore is tropical; the town being almost on the equator, there is very little variation in temperature all the year round. The effect of this on the vegetation is most marked. Palms, cacti, fruits and flowers flourish in abundance, and except where clearings have been made for building or agricultural purposes, dense jungles are still in existence, affording as safe a home for their denizens as do the jungles of adjacent Burmah.

The city of Singapore (or Sincapore) was founded in 1819 by Sir Stamford Raffles, and it is owing to his sagacity that the happy choice of Singapore was made as the site of the present flourishing commercial emporium for British trade in the East Indies. In 1824 the British Government by treaty purchased from the then resident officer or chief, called the "tumangong," for 60,000 Spanish dollars (£13,500) and a life annuity to the Sultan of Johore and his resident officer of 24,000 dollars (£5,400), the sovereignty and fee simple of the island, as well as all the seas, straits and islands to the extent of 10 geographical miles around. In 1830 it was made the capital of the Straits Settlement, superseding Penang, and to-day it is undoubtedly the most important trading center in the southeast of Asia. Its geographical position, combined with its splendid harbor, adds to its further importance as a port of call for steamship lines trading between Europe and the Far East.

The construction of the tramways was authorized by an ordinance passed by the Legislative Council of the Straits Settlements in 1902. The promoters of the scheme were the Association General, Ltd., London, and the East India Construction Syndicate, Ltd., London, which was formed for the purpose of carrying out the construction of the tramways. The consulting engineers to the company are Alfred Dickinson & Company, of Birmingham and London, who prepared all the detailed plans and specifications and superintended the carrying out of the work. The contractors for the whole of the work, which included the construction of a bridge over the Kalang River, were Dick, Kerr & Company, Ltd., of London and Preston. The work was commenced in July, 1903, and the first section of the line was opened for traffic in July, 1905.

The total length of the tramways is 16 miles of route, the length of the single track being about 26½ miles. The track is laid to a gage of 1 m, with rails of the girder type, weighing 95 lbs. per yard. The rail-joints are welded by the "thermit" process, so that the track forms one continuous length. During the initiation of the scheme considerable discussion took place as to the advisability of having welded joints, the question at issue being, of course, the variation in the temperature. It was finally decided, however, that this difficulty was of too slight a nature to affect the joints after having been securely welded together by this special process. In addition to the thermit joint, a single No. 000000 S. W. G. copper bond is supplied at every joint, thus insuring perfect electrical conductivity.

TYPICAL STREET VIEW, SHOWING ATTACHMENT OF SPAN WIRES TO HOUSES

The roadbed throughout is of a very substantial construction. The rails are laid on a longitudinal concrete stringer 8 ins. deep x 18 ins. in width. The flange of the rails is embedded in the concrete to a depth of 2 ins., and consequently there is a solid bed of concrete 6 ins. deep under the flange of the rails. The gage of the track is maintained in the usual manner—that is, tie-bars are spaced 8 ft. apart throughout. After the rails and concrete foundation were laid, the road surface up to the rail level was filled in with macadam, and was rolled and consolidated in the usual way.

The lines in the center of the city and those running to the docks are for the most part double-track, center-pole construction, while the two routes leading north and northeast along the Serangoon and Gelang Roads, respectively, are single lines with passing places, and are equipped with side-pole construction.

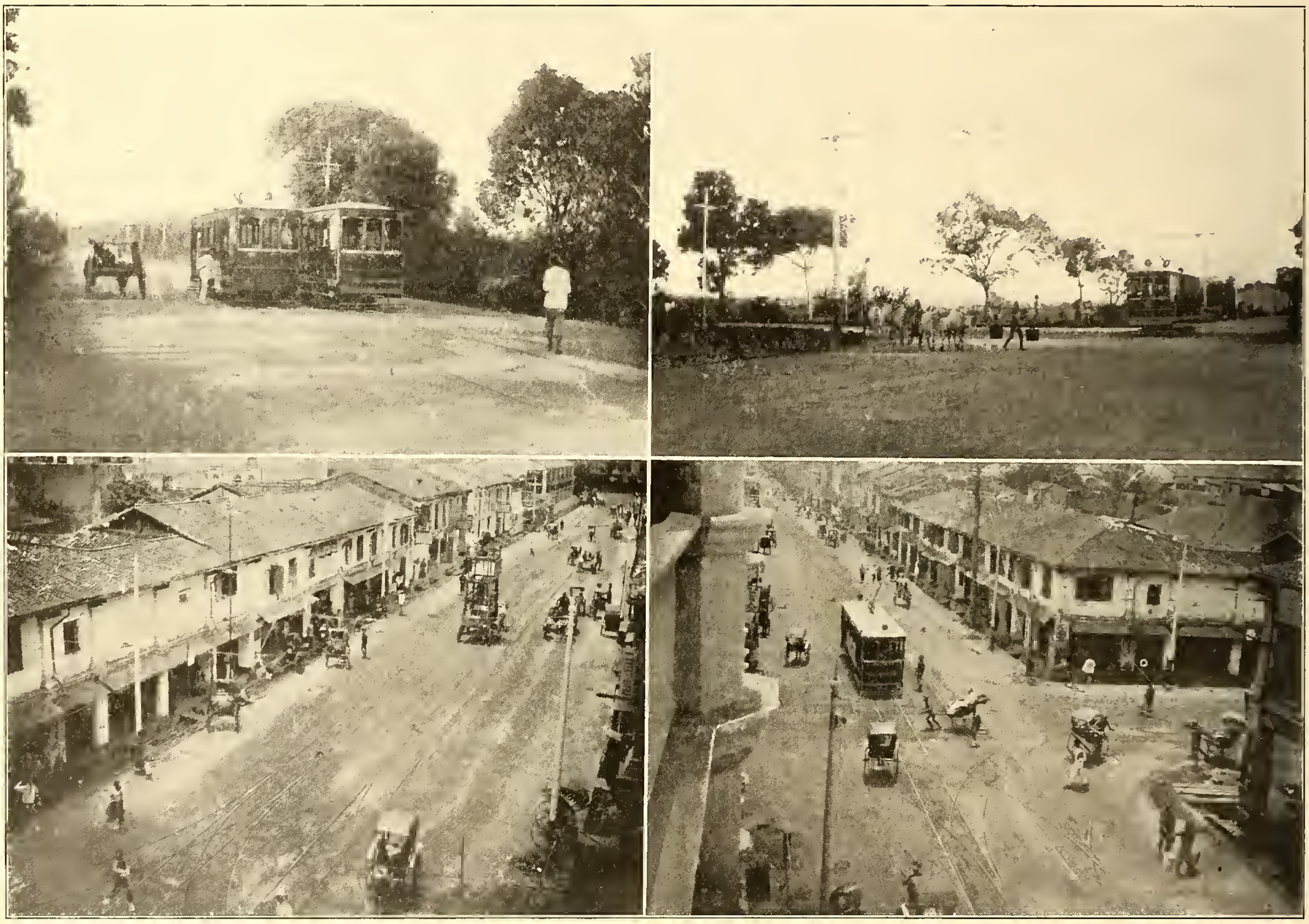
The overhead construction consists principally of side and center-pole construction, and also some 2 miles of span wire construction. The poles are of mild steel, 28 ft. 3 ins. in length, 7 ins. in diameter at the base, tapering to 4 ins. in diameter at the top. They are set 6 ft. in the ground, and are embedded in a solid block of concrete, each pole being provided with an ornamental cast-iron base. On the center poles, the lengths of arms are 2 ft., while those on the side poles vary in length according to the distance from the pole to the track.

The trolley wires, which are not necessarily over the center of the track, the possible variation being about 10 ft., are divided into ½-mile sections by means of section insulators. At each of these points the main feeder cables are tapped and current is conveyed to the trolley wires by means of 37/16 rubber-covered cables, which are carried up the inside of the poles and along the side of the bracket arms. Five hundred volts are used on the trolley wires. A lightning arrester is provided in each section pillar, as is also a telephone giving direct communication with the power house; and to guard against the tropical storms which are so prevalent in Singapore, the overhead system is additionally protected by heavy lightning arresters at every ½ mile of wire. These are fixed on the poles in cast-iron boxes and are connected directly to the trolley wire.

The feeder cables were supplied by Callander's Cable & Construction Company, and were laid by that company on its solid bitumen system. The system of feeders has been arranged with due regard to future requirements, as it is generally anticipated that within the near future the traffic will rapidly increase, both as regards passengers and the conveyance of light freight.

The power station and car house occupy a most desirable position near the Rochore Canal, from which water is obtained for condensing purposes. The depot buildings comprise the engine room and basement, boiler house, car house, machine shop, carpenters' shop, paint shop, smithy, offices of the general manager and his staff, and the usual out buildings.

The engine room is 190 ft. long x 48 ft. 9 ins. in width, and contains two railway 500-kw sets, one steam lighting set, one motor-generator lighting set and the necessary switch gear.



VIEWS ON THE SINGAPORE RAILWAY

The boiler house contains eight Lancashire boilers, arranged in two batteries of four boilers each. Each boiler is capable of evaporating 6000 lbs. of water per hour, with a working pressure of 175 lbs. per square inch. Feed-water is supplied to the boilers by four feed-pumps (two to each battery); these are of the duplex compound non-condensing type, taking water either from the hot well or storage tank. There are two Green's economizers, each containing 228 tubes, one being situated at either end of the boiler house.

The main traction engines, of which there are two in number, were built by Yates & Thom, of Blackburn, and are of their well-known horizontal cross-compound condensing type, running at 100 r. p. m., and are each capable of giving a maximum output of 927 B.HP. per minute, with a steam pressure of 165 lbs. per square inch at the cylinders. Each engine is provided with a Worthington surface condenser, but may be worked either condensing or non-condensing. In order to leave the engine room as free and open as possible, it has been arranged so that the condensers are fixed to the basement constructed below, as are also all the steam pipes and other usual accessories.

The generators were built by Dick, Kerr & Company, and

VIEW IN SOUTH BRIDGE ROAD

are of their continuous-current multipolar type, compound wound. Each machine is designed to give an output of 500 kw with a pressure of 550 volts when running at a speed of 100 r. p. m. The lighting sets are for lighting the city and depot by means of incandescent and arc lamps, and consist of one 150-kw Dick-Kerr generator, running at a speed of 350 r. p. m. to 400 r. p. m., designed for use either as a compound or shunt machine, and coupled to a Willans triple-expansion condensing engine with extension base; also a 50-kw Dick-Kerr motor-generator set, shunt wound, designed to give a normal output of 100 amps. at 500 volts, and a maximum of 115 amps. at 550 volts, and two balancers of the same firm's make, for use in conjunction with the above lighting dynamos, for 500-volt pressure.

The switchboard was built by the contractors, and is composed of fifteen panels, each supported independently on an iron frame. The board consists of a main station panel, two generator panels, five feeder panels, one Board of Trade panel, and six other panels for lighting, etc.

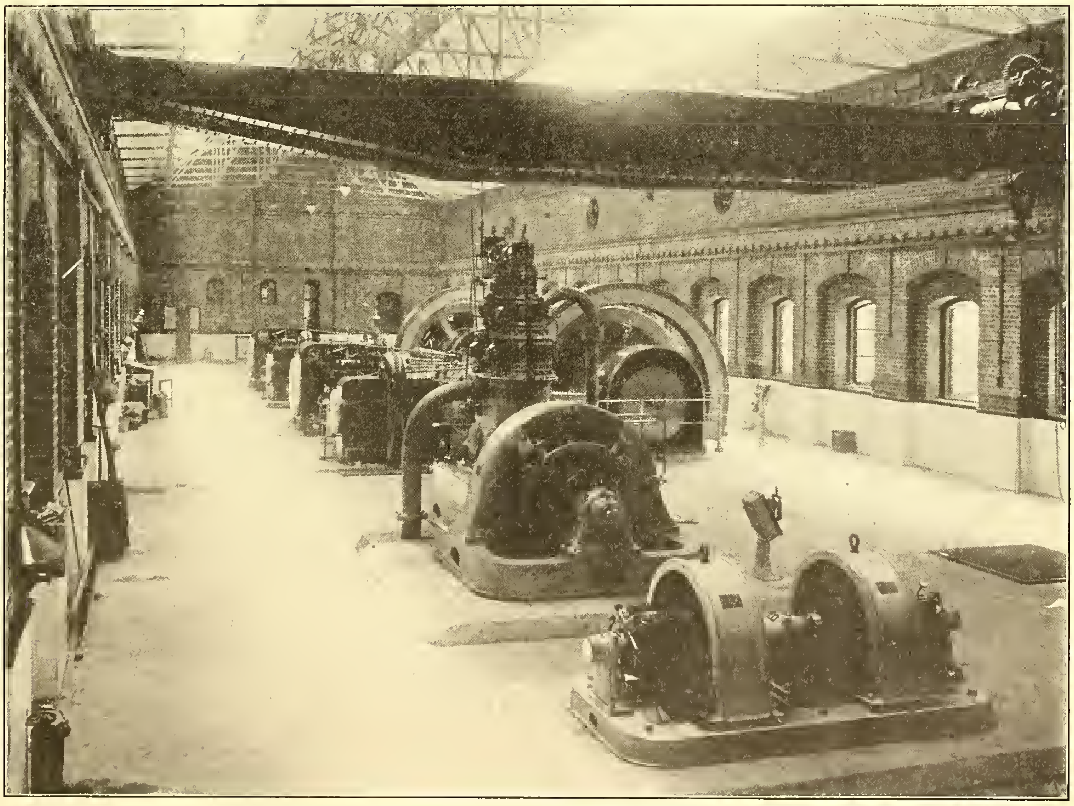
The stack, which is of steel, is 135 ft. in height and 7 ft. internal diameter, and is a notable landmark for many miles around. The base is built in a substantial manner, and is finished square on the outside, massive stone blocks being provided at the top of base to form the foundation for the circular part of the chimney.

The car shed is 212 ft. in length x 138 ft. in width, and is built to accommodate eighty-four cars. Inspection pits run the entire length of each track, with the exception of the curves at the entrance to the shed.

The rolling stock consists of fifty passengers cars, three double-truck motor freight cars, fifteen single-truck freight cars and fifteen four-wheel wagons. The passenger cars are

HAULING TIES

divided into two distinct types; thirty are of the single-deck, single-truck, open type to seat thirty-two passengers, and twenty are of the single-deck, single-truck combination type to seat forty passengers. The rolling stock was built by the United Electric Car Company, of Preston. The car bodies are



INTERIOR OF POWER STATION

mounted on Brill 21-E trucks, and each are equipped with two D.K. 25-b motors. The controllers are of the Dick-Kerr DB-1, form C, metallic shield blow-out pattern. The cars are fitted with Hudson & Bowring lifeguards.

The three double-truck freight cars are each mounted on

Brill 27-G trucks, with four D.K. 25-b motors. They are intended for use of a double purpose, that of conveying freight and hauling freight cars. The general arrangement of the body is such as to provide a self-contained car with divided sliding doors on each side, which may be securely locked up, and a vestibule canopy at each end as the platform for the drivers. The fifteen single-truck freight cars are equipped in a similar manner to the passenger cars. They are 12 ft. in length and 6 ft. 6 ins. in width. These cars are for general use for the conveyance of various classes of goods up to 6 tons in weight. The frame is made of mild steel channels, stayed by longitudinal and cross stays, knees and gusset plates. The side of each car is provided with strong hinges. To protect the goods from the weather, each car is supplied with a detachable light angle-iron frame, upon which a tarpaulin is spread the full length of the car at a height of 7 ft. from the floor.

A NOTE ON THE ELECTRIFICATION OF TRUNK LINE RAILWAYS

BY H. WARD LEONARD

For many years past, the writer has been asserting the correctness of the following propositions:

(1) The comprehensive electrification of existing trunk line railways will begin as soon as the managers of such railways are convinced that the cost per ton-mile can be reduced thereby, and not until then.

(2) The cost per ton-mile is principally dependent upon the amount of power efficiently applied to a freight train.

(3) It is impossible materially to increase the average power of the steam locomotive above that represented by the best modern locomotives, and it is impracticable efficiently to operate under multiple control a plurality of steam locomotives hauling a train.

(4) It is readily and economically possible to apply any desired power to a train by means of electric locomotives and the methods of control available to-day.

(5) The replacement of steam locomotives by electric locomotives is a paying proposition to-day, upon a large percentage of our trunk line railways, and will begin as soon as railway managers appreciate what can be accomplished by the best inventions, electrical engineering and apparatus available to-day.

There are, as yet, but few reliable data bearing upon the cost per ton-mile and the relationship of train power thereto. The first comprehensive statistics as to the locomotives in the United States were published in 1903, in the Railway Statistics of the Interstate Commerce Commission, for the year ending June 30, 1902. Since then, similar statistics for the two years ending, respectively, June 30, 1903, and June 30, 1904, have been published, so that now the statistics of three years are comparable.

The following facts are significant: (The figures are stated in round numbers.)

The duty of the average United States locomotive in 1894 was 4,000,000 ton-miles, and in 1904 it was 6.5 millions. The duty of the average freight locomotive on the Pennsylvania Railroad system is over 9,000,000 ton-miles; in the case of the Union Pacific Railroad, it is between 8,000,000 and 9,000,000.

The average weight on drivers for all United States locomotives has been increasing year by year, and in 1904 was 50 tons. The average weight on drivers of the Union Pacific locomotives for 1904 was 60 tons. The average weight on drivers of the new locomotive put in service by the Union Pacific in 1904 was 78 tons. The new locomotives added by the Southern Pacific in 1904 averaged 83 tons on drivers.

During the past seven years the average trainload of Union Pacific trains has been increased 74 per cent.

While it is not necessarily true that the power is proportionate to the weight on drivers, or to the trainload, unless the speed is maintained constant, the statistics as to the weight on drivers and trainloads are the best ones reported, from which an approximate idea of the power can be obtained.

Another close indication of the power is to be found in the heating surface of the locomotives. Statistics as to the average heating surface of all United States locomotives are now available for the three years ending June 30, 1902, 1903 and 1904, and the average square feet of heating surface per locomotive is 1562, 1659 and 1748, respectively. The average trainload for all United States railways was, in 1894, 180 tons; in 1904 it was 308 tons. The Great Northern trainload was 522 tons in 1904 and the Union Pacific trainload was 507 tons in 1904. It is well known that the railways named are leaders as regards progressive and economical management, and the fact stands out conspicuously that they have an extraordinarily high train power and are making every effort to increase the train power by replacing their old locomotives with those of the highest power practicable.

The average age of the locomotives in service in the Southern Pacific was, in 1904, thirteen years, and the maintenance charge per annum was $3,500 per locomotive, which are fairly representative figures. Although statistics of this nature are not available as to electric locomotives, it seems altogether likely that the life of electric locomotives will be very much longer and the maintenance charge but a fraction of that of the modern steam locomotive.

The cost of electrification of steam railways will, of course, vary considerably, but it is probable that with the best systems of electrification the average cost will not exceed $60 per horse-power in the locomotive.

One horse-power in the locomotive produces an output of about 13,000 ton-miles per annum on the existing railways.

Based upon the average revenue per ton-mile in the United States, the earning power of the average United States locomotive is about $100 per horse-power per annum. The total railway capital at present employed in the United States railways is about $600 per horse-power. The electrification of an average existing railway means an increase of its total capital of about 10 per cent, to provide the same total horse-power as it now uses. If it be assumed that the ton-miles per annum on United States railways will increase, in the future, at the same rate as during the past ten years, and that the railways will be comprehensibely electrified by 1925, it is estimated by the writer that not less than $1,200,000,000 of electrical apparatus will be required for this purpose alone during the next twenty years.

When the construction of a new trunk line railway is considered, there is an enormous advantage in favor of electric traction over steam traction which is not properly appreciated. This is due to an inherent defect of the steam locomotive in that its horse-power when hauling a certain train, falls off rapidly as the grade is increased. Also, simultaneously, the cost per horse-power-hour rapidly increases. While these facts are well known, their economic significance in the cost of construction and operation of a railway is not generally appreciated. It is probably true that the largest individual expenditures in the construction of a new railway, located with the highest skill, can be directly traced to this inherent defect of the steam locomotive. Enormous expenditures of capital are made in railway construction in order to escape the inefficiency of operation which would result from operating the steam locomotive on grades heavier than a certain limiting grade.

Given a locomotive whose horse-power is constant over the range of speed and tractive effort desired in practice, and whose cost per horse-power-hour is constant, independent of the variable tractive effort required in practice and a new economic theory of railway location immediately presents itself, with possible savings of capital expenditure in the construction of the railway which will very materially reduce the total capital needed. Such a locomotive is available to-day in the type of electric locomotive in which a voltage control of the speed is employed, and in which, as a consequence, the total horse-power and the cost per horse-power-hour can be maintained constant over the range of tractive effort desired in practice.

Other features of important superiority possessed by the electric locomotive are its ability to develop, for an hour or so, a greatly increased power; also its ability to regenerate useful energy in going down grades and for breaking generally.

It is altogether likely that if two new railways were located, for the same duty, across a mountainous region, between the same terminal points, by two routes, one being the best location for steam traction and the other the best location for electric traction, it would be found that the first cost of the complete railway located for electric operation would be very materially less than the first cost of the equivalent railway located for steam traction; and the cost of operation would also be materially in favor of the electric railway.

An engineering project of such vast importance as that presented by the comprehensive electrification of a trunk line railway can only be properly dealt with by a commission composed of the ablest engineers of the world, selected from various countries. The Niagara Commission was of this type, and the perfection of its work, from an engineering standpoint, reflects the highest credit upon it and also upon the management which appreciated the impossibility of getting the best result by relying upon manufacturers of electrical apparatus or engineers from any one country. As soon as a similar international commission of the ablest engineers available considers and decides as to the advisability of electrifying one of our leading railways, the superiority of electric traction over steam traction will be promptly demonstrated.

Meantime, railway managers must content themselves with hopes as to the "systems" of the two rival manufacturers who dominate the railway field in this country, and whose interests are pooled as to patents in such a way as to effectually stifle inventions and electrical engineering in the railway field other than such as they control.

CORRESPONDENCE

THE ROADMASTER SYSTEM IN TAMPA

TAMPA ELECTRIC COMPANY

Tampa, Fla., Jan. 11, 1906.

Editors Street Railway Journal:

We have been very much interested in the article headed "The Roadmaster System in Toronto," page 141, in your issue for Dec. 30, 1905. This explains the plan of the Toronto Railway Company of appointing what are called "roadmasters" from regular motormen on each division of its lines, giving these motormen regular salaries and assigning to them the special duty of looking after the proper operation of its various divisions. You will perhaps be interested to know, and so will the Toronto Railway Company, that a little over two years ago we planned out here for our little road a very much similar scheme. It was our own idea, and it has worked out very nicely.

We operate nineteen regular cars and from three to seven extra cars during the crowded parts of the day and on crowded days. We have five divisions, the largest operating five regular cars and the smallest two. A little over a year ago we appointed five of our best conductors and five of our best motormen to what we have termed "division conductors" and "division motormen." They were given gilt badges, on which was printed their title, and small gilt stars, which were sewed on their sleeves.

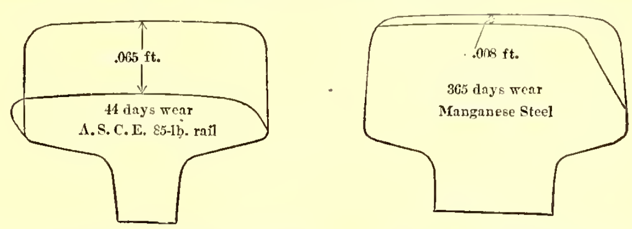
These men receive a regular salary, which is about $5 per month more than our regular third-year men. They report to us any inattention to duty of the other men, and we look to them especially to maintain schedule and proper discipline of the other men on their various divisions. If an extra inspector is required for a short time, we pick a man from among these division men, and would also appoint an inspector from among these men should it become necessary. With very little more cost, we have helped our organization very much, have encouraged the other men to pay strict attention to duty in order to try to obtain one of these positions, and we have ten men upon whom we could rely in case of any trouble among our employees. There was one plan mentioned in your article that we had not thought of—that is, to allow a division motorman to change from one car to another with other motormen, but we think very favorably of this idea and will try it with one or two of our men.

Besides the superintendent, who operates the cars and has charge of the shops, we have one inspector in uniform, and they, together with our division men, make our organization very complete. We, of course, continue to have our troubles in maintaining discipline, and a portion of our force is continually being renewed, but these division men are a great assistance to us.

George W. Wells, Manager.

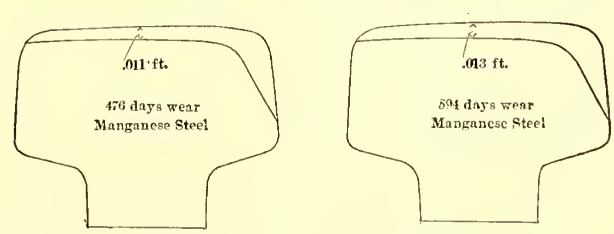
CURVE WEAR ON THE BOSTON ELEVATED

Statistics have been published from time to time in this paper in regard to the wear on the curved rails in the subway and on the elevated structure of the Boston Elevated Railway Company. As will be remembered, the distance from Dudley Street to Sullivan Square is 6½ miles, and the total mileage,



FIGS. 1 AND 2.—SHOWING CHANGES OF ORDINARY 85-LB. RAIL AFTER 44 DAYS, AND MANGANESE STEEL AFTER 365 DAYS

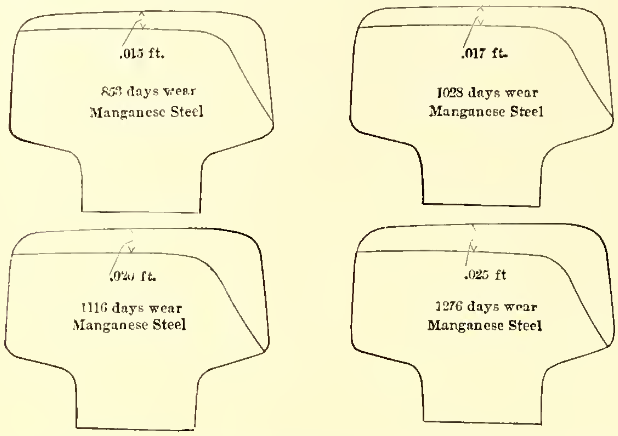
including sidings, is 16.015 miles. Over 40 per cent of this distance consists of curves with radii varying from 82 ft. to 5000 ft. Very few of these curves have large radii, and there are eighteen curves of less than 100 ft., and sixteen others



FIGS. 3 AND 4.—SHOWING CHANGES IN MANGANESE STEEL RAILS AFTER PERIODS OF 476 DAYS AND 594 DAYS, RESPECTIVELY

with less than 150-ft. radii. On the entire division the total curvature is 13.4 circles.

One of the points of most severe wear is on the outer south half of the reverse curve entering Park Street station, south bound, where the radius is 82 ft. At first, ordinary commercial rails were laid on this curve, and the wear in forty-four days is given in Fig. 1, which shows a section of an 85-lb. rail laid March 13, 1902, and removed April 26, 1902. After considerable experimenting with nickel steel and other steel, a manganese steel rail was laid at this point April 26, 1902, and the accompanying sections show the wear of this rail at different intervals during that time up to Oct. 23, 1905, when the



FIGS. 5, 6, 7 AND 8.—SHOWING GRADUAL WEAR OF MANGANESE STEEL RAILS FOR PERIODS RANGING FROM 853 DAYS TO 1276 DAYS

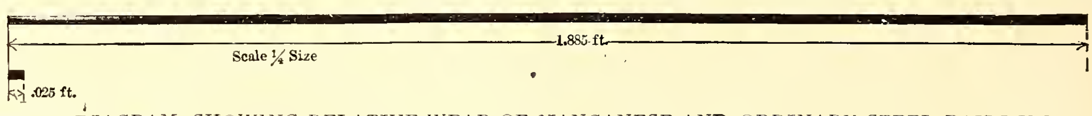


FIG. 9.—DIAGRAM SHOWING RELATIVE WEAR OF MANGANESE AND ORDINARY STEEL RAILS UNDER THE BOSTON CURVE CONDITIONS

rail was removed. Manganese rails are being used at other points of severe wear on the subway and are giving good satisfaction, and from all appearance are good for a long period of service.

DISCUSSION ON SUB-STATIONS AT THE A. I. E. E. MEETING IN CHICAGO

A very profitable discussion of the papers, "The Relation of Railway Sub-Station Design to Its Operation," by Sydney W. Ashe, and "Some Considerations Determining the Location of Electric Railway Sub-Stations," by C. W. Ricker, occurred at the January meeting of the Chicago branch of the American Institute of Electrical Engineers, held Jan. 16. These papers were previously read and discussed at the New York meeting of the Institute. At the Chicago meeting, the papers were briefly abstracted by Prof. Woodworth.

George A. Damon, when called upon to open the discussion, said that Mr. Ricker's paper referred to the Kelvin law for proportioning conductors. He had never encountered a problem where he had been able to use this law. On one occasion, when laying out a sub-station and distributing system for a large city, he had thought the law could be applied, but found on further consideration that the location and the distribution of the loads determined at once certain critical points for the location of sub-stations without entering into any deep calculations. Mr. Damon added that the practice of tieing together the d. c. sides of a system fed by several sub-stations reduced the necessity of carrying reserve capacity in each station, as in case of a break-down the section fed by the station out of service could obtain current from the surrounding stations over tie lines.

Peter Junkersfeld thought protective devices were not well standardized. Different theories existed, and there was room for much improvement in the protection of sub-station apparatus. He brought out a rather interesting phase of sub-station building design in large cities. In view of the fact that new methods of distributing current may arise or some other condition may develop, which may make it advisable to abandon the sub-station, the buildings are now often built along strictly commercial lines. Should the station be abandoned at any time, the property ought then to be valuable for rental purposes. In some instances, in designing buildings with the idea of future occupancy for commercial purposes, the ceilings over the machinery floor have been placed so low as to prevent the installation of a crane, and a traveler is used instead. In other instances, in order to permit a crane over the machinery, the second floor has been omitted, but the walls have been so constructed that the floor can be readily inserted should occasion arise. Mr. Junkersfeld remarked that he had not found that in a sub-station a crane reduced very much the cost of installation or maintenance. Storage batteries were an important part of a large system. He agreed with Mr. Damon that Kelvin's law was not employed much in practical work, but added that in many cases the law was probably used unconsciously.

J. M. S. Waring said that one paragraph in Mr. Ashe's paper was somewhat misleading. This was the paragraph which stated that because of the slowness of the chemical action of the battery it did not always take the peak of the load in case of short-circuit, but permitted the converter to flash over. He said in almost all cases of battery installations, boosters were employed, and these would do much to obviate the trouble referred to. Mr. Waring spoke of an occasion when a battery was installed to advantage. On an interurban line the sub-stations were 14 miles apart. At a point half-way between sub-stations there was a branch line to some amusement parks. On summer evenings and Sundays the load was unusually heavy at this junction. A line battery was installed at the junction and the booster was located in one of the distant sub-stations.

Ernest Lunn did not think the slowness of the action of a battery, in a case of short-circuit, due to the velocity of migration of the ions of the electrolyte, but rather to the internal resistance of the cell, and this, he suggested, could often be lessened by increasing the size of the terminal lugs.

Bion J. Arnold said he was quite a friend of the storage battery several years ago, when it was not as popular as at the present time. He was first under the impression that the use of batteries gave better generating efficiency, but now he was not so sure of that, but believed there were other good and sufficient reasons for their installation. The increased reliability of the system obtained by their use was the determining feature in the New York Central electrification. The plan to install inverted rotaries and storage batteries in a. c. work, he said, would decrease the reliability of the system, as there would be a revolving piece of apparatus between the battery and the line.

In reply to a question of L. M. Zapp as to why the carbon regulator described in Mr. Ashe's paper could not be connected directly in the fields of the booster instead of in the fields of the booster exciter, Mr. Waring stated that this was done in smaller installations. In the larger ones, however, the large current required by the booster fields would complicate the carbon piles of the regulator if they were made to carry the current.

Chairman Ferguson asked for a discussion of the question of "How far we should go in efforts to protect the apparatus? Were we making so much of an effort to protect apparatus by means of various safety devices as to make the system unreliable?"

W. G. Carlton, in discussing this question, called attention to the fact that a short-circuit on a low-tension direct-current system is very different in its nature from one on a high-tension alternating-current system. The low-tension short-circuit could be frequently burned off without interruption to the service. A short-circuit on a high-tension alternating-current system could not be burned off without putting the whole system out of operation, because of the enormous amount of power flowing to such a short-circuit and the presence of the large amount of synchronous apparatus which would be pulled out of step in case of a heavy short-circuit.

Mr. Moran urged the installation of all the lightning protective apparatus as possible. He also believed in the use of reverse current relays. Prof. Woodworth asked what would happen in case an overload relay operating from a current transformer failed to act, due to a failure of the current transformer. L. M. Zapp said that the remedy was to put in two current transformers and two relays.

Mr. Junkersfeld outlined the system he considers best for protecting the service and the apparatus. Two or more independent lines are run between the power station and sub-station. The rotary converters at the sub-station are equipped with overload relays of the bellows type on the alternating-current side. Reverse current relays are placed on the direct-current side, and a speed-limit device on the converter for throwing the converter out of circuit in case the speed rises a certain per cent above normal. He called attention to the importance of providing against operating mistakes in a large system where from 100 to 150 switchboard operators might be employed. It could easily be seen that a very small percentage of mistakes on the part of the operators would count up seriously in interruptions to service.

Mr. Moran cited cases where starting from the alternating-current side of rotary converters caused much less trouble, and where it took from 15 to 20 minutes sometimes to synchronize a rotary converter started with an induction motor on the shaft.

Mr. Winslow thought that we could not do without any one of the three protective devices named by Mr. Junkersfeld, namely, overload relays on the alternating-current side of converters, reverse current relays on the direct-current side, and speed-limiting devices. He spoke of some overload time-limit relays operating in from 3 to 6 seconds with 100 per cent overload.

Mr. Carlton said that there was great difficulty in securing relays in which there would be any appreciable difference in the time taken to operate on short-circuits. Considerable investigation and testing by Mr. Eastman, of the Chicago Edison Company, had failed to discover any time-limit devices which could be placed on feeders at sub-stations and at power stations with the assurance that there would be sufficient difference in the time of operation on short-circuits so that the circuit breakers at the sub-stations could be set to open before those at the power station.

Mr. Winslow said that protective devices should be tested every seven to ten days, and that men must be employed who can be relied upon to go through these tedious routine tests faithfully and not mark things as tested O. K. simply because they tested all right the last time. Mr. Moran cited cases where the temperature had great influence on the time of operation of the bellows type of relay. Edward Schildhauer thought it was desirable to cut out a line instantly in case of short-circuit. Relays set for operation in 6 seconds at 100 per cent overload should operate instantly on short-circuits.

Chairman Ferguson, discussing the battery as a safety device to insure against interruptions of service, referred to the fact that his company now has some 12,000-kw capacity in storage batteries on a system having a maximum output of about 52,000 kw. He again asked for more expression of opinion as to how far we should go in the use of safety devices.

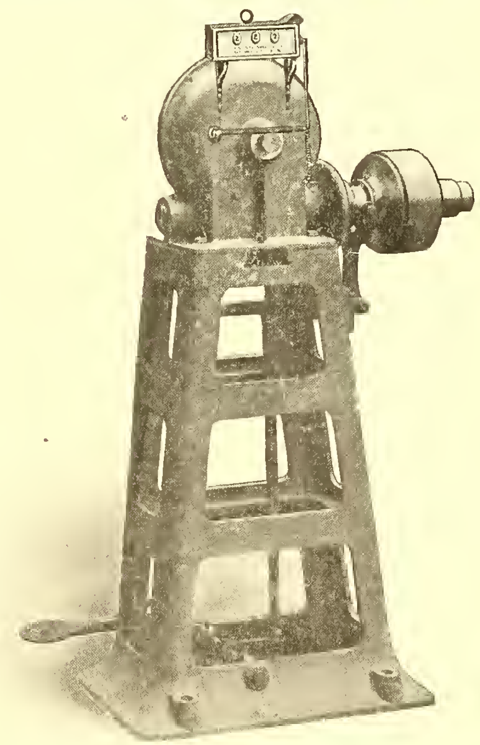
E. O. Sessions cited cases where reverse current relays had not given satisfaction in sub-stations where a very cheap grade of sub-station operators was employed. Mr. Ferguson thought that the answer to the question raised by Mr. Sessions was "Don't throw out the reverse current relay, but the operator."

D. W. Roper said that the aim in designing any large distribution system should be to prevent local faults and troubles from affecting the whole system. Messrs. Hammond and Lunn spoke briefly of European practice.

Mr. Junkersfeld called attention to the fact that of all the protective devices enumerated, the one limiting the speed of rotary converters was the only one installed primarily to protect the apparatus. The other devices were for the protection of the service from interruption by preventing the spread of disturbances. After all, protection of the apparatus was not a very serious question in practice, as was shown by the fact that on a large lighting system having from fifty-five to sixty switchboard operators and aggregating about 70,000 kw in machinery capacity, only three cases of damage to rotary converters had occurred in five years of operation.

ARMATURE AND FIELD COIL WINDING MACHINE USED IN BROOKLYN

The Brooklyn Rapid Transit Company has just installed at its Fifty-Second Street shops, Brooklyn, N. Y., eight armature and field coil winding machines, made by the American General Engineering Company, of New York. Reference to the accompanying illustration will show clearly the compact con-



ONE OF THE NEW ARMATURE AND FIELD COIL WINDING MACHINES INSTALLED BY THE BROOKLYN RAPID TRANSIT COMPANY

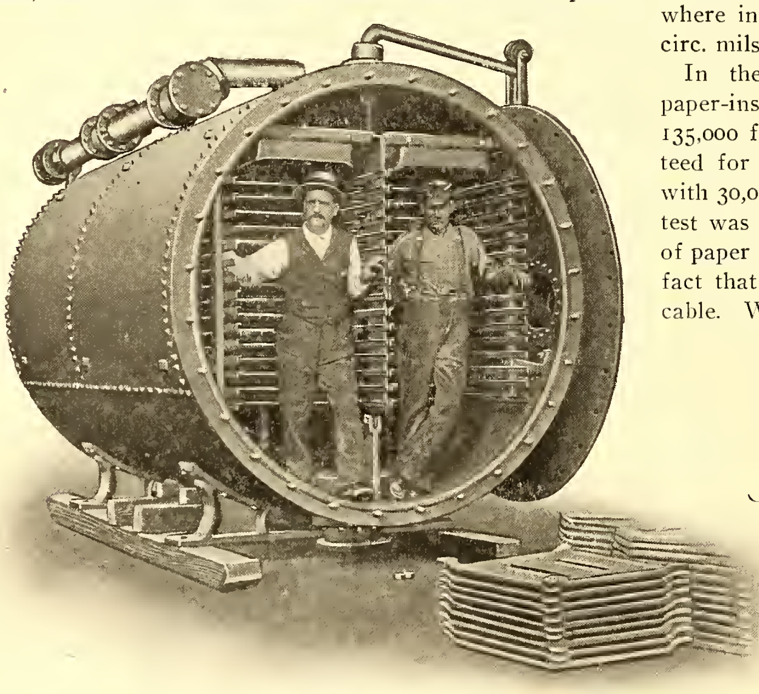
struction of this machine; in fact, it occupies only 4 ft. of floor space, making it especially suitable for installation in shops where space is valuable.

Every precaution has been taken in making this machine to prevent interruptions in operation. The gears are enclosed in a case, which prevents the dirt and dust from getting to them as well as the coils, and also perfect lubrication and general protection. The machine has absolutely no back lash and will make a positive stop on the release of the lever by the operator's foot. It is fitted with a recorder, giving the number of turns, to save the operator the necessity of counting. As a labor saver, it is claimed that this device will repay its first cost in six months' service.

THE PHILADELPHIA RAPID TRANSIT COMPANY'S 16,000-HP FEED-WATER HEATER

With the increased size of power plants for street railway work has come the demand for larger units and a corresponding increase in the size of the auxiliaries. The size of feed-water heaters, however, is not always governed by the size of the separate units, as one heater may be made to serve two or more units. This has resulted in the installation of some very large heaters, among which is one of 16,000 hp, recently furnished by the Hoppes Manufacturing Company, 51 Belmont Avenue, Springfield, Ohio, to the Philadelphia Rapid Transit Company.

This heater is of the cast-iron type, and is known as class "R," to distinguish it from the standard heaters manufactured by this company of steel plate construction. The bottom of the heater, pans and all the working parts which come in contact with the water are of cast iron, as this material is more durable for a certain service than steel plate. To save weight, however, the shell above the water line is made of steel plate.



VIEW OF PHILADELPHIA RAPID TRANSIT COMPANY'S 16,000-HP HEATER, SHOWING ALSO TYPE OF PANS USED

The diameter of this heater is 7 ft. 6 ins., and the length, 15 ft.

The pans used in the heater are of the multi-trough-shaped pattern cast in one piece from a good grade of gray iron. The entire heating and lime catching surface represented by the pan aggregates over 2000 sq. ft. The shape of the pans is clearly shown in the illustration, the form being such that the water is made to flow over the sides and through the slots; following the underside of the pans in a thin film it then comes into direct contact with the exhaust steam in the heater, even when the pans are coated with lime or other solids.

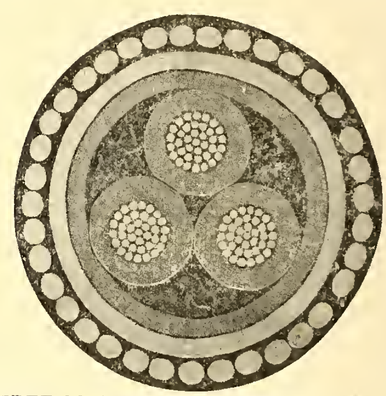
The very large amount of heating and lime catching surface, together with the settling chambers provided by the trough-shaped pans, renders a filter unnecessary, although the manufacturer furnishes filter plates when desired. A large oil eliminator is installed in the rear end of the heater where the exhaust steam enters, and an outside float box with float for regulating the feed-water by a balanced valve is also provided.

As will be seen by the illustration, the entire front head of the heater is removable, giving easy access to all parts of the machine for cleaning and inspection. In cleaning the heater, the pans only need be removed and cleaned, and this work may be done outside of the heater. This company builds heaters of this type from 100 hp to 30,000 hp.

CABLES IN THE LONG ISLAND ELECTRIFICATION

In the account of the electrification of the Long Island Railroad, published in the STREET RAILWAY JOURNAL for Nov. 4, only a short description was given of the feeder cables and interior wiring used in the generating station and sub-stations. For the latter, about 19,000 ft. of 11,000-volt varnished cambric insulation, braided finish cable were installed. All of this cable was tested by the manufacturer with 30,000 volts for 30 minutes after it had been immersed in water for 24 hours, and was again tested with the same potential after installation. Varnished cambric insulation was selected as the best available insulating material for this use, as it is claimed that cables insulated with this material are better for withstanding high voltage than those insulated with rubber, and are not subject to deterioration from static discharges or heat. Furthermore, the fact that these cables could be used without lead sheaths avoided the installation of a large number of end bells. Varnished cambric insulation with the braided finish was also used for the low-tension wiring in the generating and sub-stations, where in all about 36,000 ft. of cable in sizes from 2,000,000 circ. mils down to No. 2 was installed for this work.

In the underground transmission circuits, lead-covered, paper-insulated cable was employed. For this purpose about 135,000 ft. of three-conductor, 250,000-circ.-mil cable, guaranteed for 11,000 volts, was used. This cable was also tested with 30,000 volts for 30 minutes by the manufacturers, and the test was repeated after the cable was installed. The selection of paper cable for this service was determined primarily by the fact that it was considerably cheaper than varnished cambric cable. While there is no question but that the varnished cambric cable would have been better, it was felt that satisfactory life and service would be obtained with the paper cables, assuming that proper care was taken to preserve their lead sheaths from deterioration, due to electrolysis or corrosion.



THREE-CONDUCTOR, 250,000-CIRC. MIL, 11,000-VOLT SUBMARINE CABLE

For carrying the high-tension circuits under water, where the drawbridges interrupt the overhead circuits on the line across Jamaica Bay, there was used 3500 ft. of the three-conductor, 250,000-circ.-mil, rubber-insulated, leaded and wire-armored submarine cable shown in cross section, less than two-thirds actual size. As in the previous cases, this cable was tested at 30,000 volts before and after installation. The cable weighs 18 lbs. per foot, and is one of the heaviest ever manufactured. The armor is No. 4 B. & S. gage, and the finished diameter about 3 ins. In connection with the third-rail circuit for jumper cables at grade crossings, and in places where the third rail was shifted from one side to the other of the main track, 65,119 ft. of 2,000,000-circ.-mil varnished cambric cable, leaded, with a jute and asphalt finish, were installed. The jute and asphalt jacket was put on these cables to protect the lead from mechanical injury and corrosion, since the cables are in many cases buried directly in the earth.

To carry the third-rail circuits and also the track circuit around the drawbridges at Jamaica Bay, 5600 ft. of 2,000,000-

circ.-mil, rubber-insulated, lead-covered and wire-armored cable were installed. The submerging of these cables maintains them at a low temperature, which tends to preserve rubber and justifies its use in this case. As a reinforced feeder for the third rail, there was installed, in conduit, 9438 ft. of paper-insulated, low-tension cable, selected as the cheapest available construction for the service, since the installation was regarded as being of a more or less temporary nature, and because the ultimate life of the cable was not an important feature.

All the above cable, as well as the necessary wire and cable for the cars, was furnished by the General Electric Company. The aggregate length of all kinds of wire and cable supplied for this installation was 637,243 ft., the sizes ranging from No. 12 to 2,000,000 circ. mils.

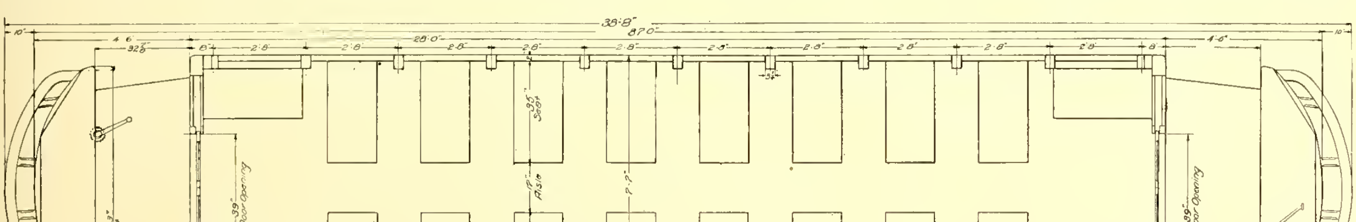
SEMI-CONVERTIBLE CARS FOR LISBON, PORTUGAL

When the street railway system of Lisbon, Portugal, commenced to operate with electricity about five years ago, 120 eight-bench open cars, built by the J. G. Brill Company, were put in service. These cars were mounted on the builder's type of single truck. Two years later the same company furnished forty twelve-bench open cars mounted on its maximum-traction trucks, and within the last week or two twenty handsome cars of the grooveless-post, semi-convertible type have been shipped. These are not the first semi-convertibles of this type to be used in Portugal, as a year ago practically the same style

SEMI-CONVERTIBLE CAR USED FOR NARROW-GAGE LINE IN LISBON, PORTUGAL

of car, but mounted on No. 27-G short base, double trucks, was furnished to Oporto.

Heretofore both open and closed cars have been used, but the climatic conditions of Lisbon make the semi-convertible type especially desirable, for the winters are mild, with many warm days, and during the summer the evenings are always



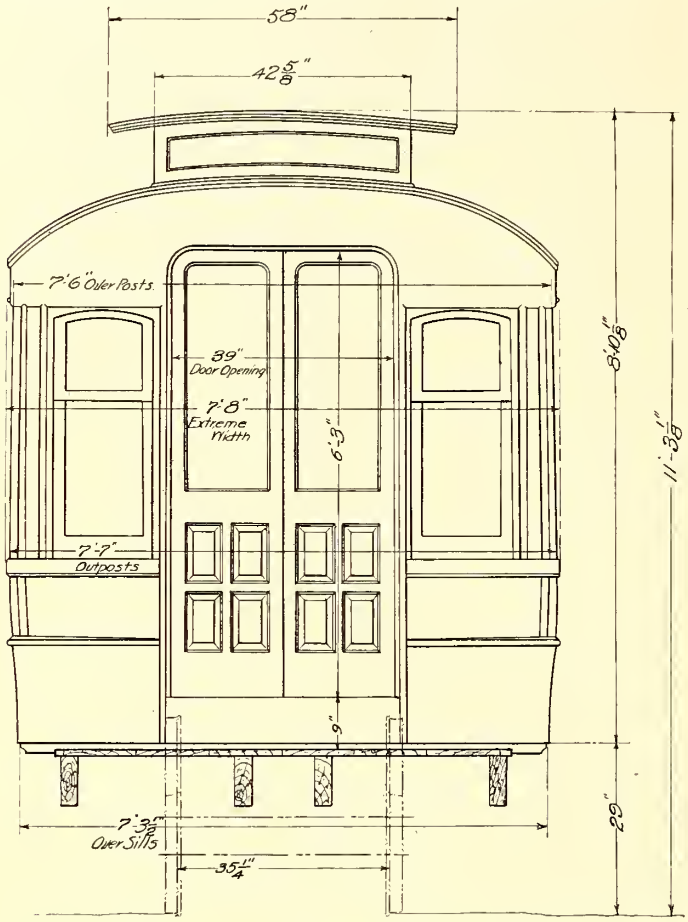
SEATING PLAN AND GENERAL DIMENSIONS OF CARS FOR NARROW-GAGE TRACK IN LISBON, PORTUGAL

cool. In the Street Railway Journal of March 2, 1901, a general description of the railway system, with maps, diagrams and half-tone views, was published. It was said in this interesting article that the street car lines were first operated in 1873. Most of the cars, which were drawn by mules, were built by the John Stephenson Company, and many of them are still in service. The type of vehicle which had previously been the chief means of transportation was a form of omnibus, and these vehicles, having the same wheel gage as the cars, made use of the company's rails, as the streets were roughly paved, and, by charging lower fares, secured enough of the traffic to

INTERIOR OF LISBON CAR

prevent adequate returns on the railway investment. This condition of affairs, although interrupted for a time by the purchase from the proprietor of the omnibuses, continued until the electrification of the lines, when, to avoid further use of the tracks by these vehicles and limit the competition, the gage was reduced from 4 ft. 8½ ins. to 2 ft. 11½ ins., too narrow for safe operation of any road vehicle of an omnibus type. The rails are of the 7-in. grooved girder type, weighing 91 lbs. to the yard, with welded joints, and laid on an excellent foundation. The power house, car houses and general equipment are thoroughly modern.

This semi-convertible type is particularly applicable to the conditions referred to, which limit the width over all to an extent which would otherwise make it impracticable to use a transverse seating arrangement. The gain of 7½ ins. in the interior width, because of having the sashes stored in pockets in the side roof when not in use instead of in the side walls, enables a 35-in. seat to be used, leaving the aisle 17 ins. wide. The seats are of the step-over type, and were manufactured by the Brill Company. The interior finish consists of cherry in the natural color, and the ceilings are of decorated birch veneer. The usual form of bottom framing is used, which includes 4-in. x 7¾-in. side sills, 12-in. x ⅜-in. sill plates and 5¼-in. x 6⅞-in. end sills. Two 4-in. x 3-in. x ½-in. angle irons support the platforms at their centers. These angle irons extend 4 ft. 4 ins. back of the centers of the body bolsters. The general dimensions need not be given, as they will be found in the accompanying plan and section. The angle-iron bumpers, radial draw-bars, ratchet brake handles, platform gongs, signal bells, sand boxes, folding gates and other specialties are of the builder's manufacture, and the cars are mounted on the build-



END VIEW OF LISBON CAR FOR NARROW-GAGE SERVICE, SHOWING PRINCIPAL DIMENSIONS

er's maximum-traction trucks, which have 4-ft. wheel base and have 33-in. x 20-in. steel-tired wheels. The motors are of 37-hp capacity each.

FREIGHT BUSINESS ON THE LANSING & SUBURBAN

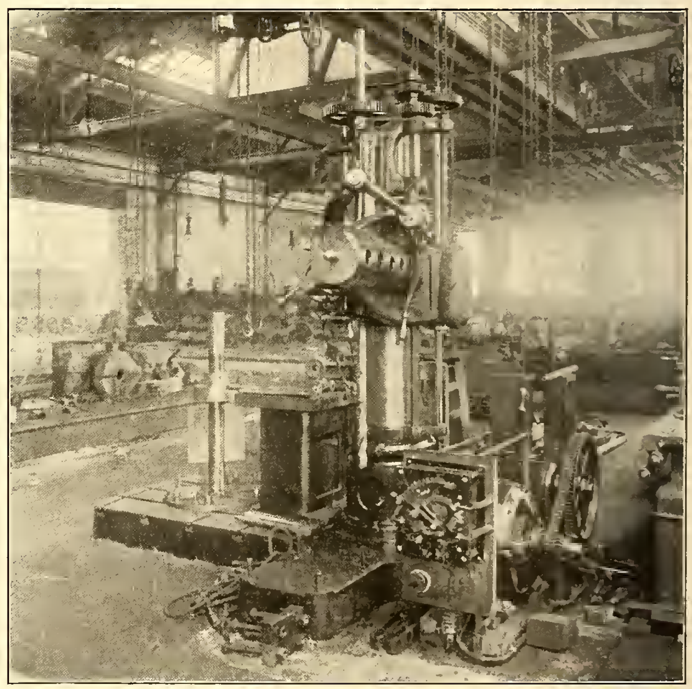
The Lansing & Suburban Railway has found it necessary to establish a freight station at Lansing in order to care for its growing freight traffic. Within the last year the traction company's freight business has grown to extensive proportions. That class of traffic on the St. John's line has been steadily increasing ever since the road was opened. In fact, it has exceeded the expectations of the company. Considerable freight is also handled on the Pine Lake line, and that road's business will undoubtedly increase this year. During the coming season the line to Jackson will be completed. Freight business over it will undoubtedly be larger than over the other lines.

Niagara Falls, Tonawanda, Lockport, Hamburg, Kenmore, Williamsville and other towns that are directly connected with Buffalo by electric railway will profit greatly in time of fire and when the aid of the Buffalo fire department is necessary, by an arrangement which the Board of Fire Commissioners has recently entered into with President Henry J. Pierce, of the International Railway Company. The company, in case these towns need the services of apparatus from the Buffalo fire department, will transport it on flat cars, the transportation charges to be borne by the town calling for aid.

RADIAL DRILL IN PHILADELPHIA SHOPS DRIVEN BY INTER-POLE MOTOR

The Philadelphia Rapid Transit Company has been using in its repair shops since May, 1905, a motor-driven radial drill, which represents an interesting application of the inter-pole motor to a machine tool whose work involves frequent variations in speed. It is worthy of note that the drill was equipped with a speed-changing mechanism to adapt it for a constant-speed motor, but owing to the ease with which the inter-pole motor can be made to vary its speed, it was adopted in place of the constant-speed motor generally employed. The driving mechanism consists of a Renold silent chain, which transmits power from a 3-hp, 525-volt, type S, "inter-pole," variable-speed motor, made by the Electro-Dynamic Company, of Bayonne, N. J. The motor is geared for 575 r. p. m., the ratio being 3 to 1, or 575 r. p. m. to 1725 r. p. m. A Bickford drill is used.

The drill arm is attached to a column 11 ins. in diameter, and is made in pipe section to overcome the combined stresses of twisting and bending. It is raised and lowered by power under the control of a lever within the operator's reach. The back gears are fitted with friction clutches, which give four changes of speeds for each position of the driving belt or set of driving gears. The spindle has sixteen changes of speed, arranged in geometrical progression, and is provided with both hand and power feed, quick advance and return, safety stop, automatic

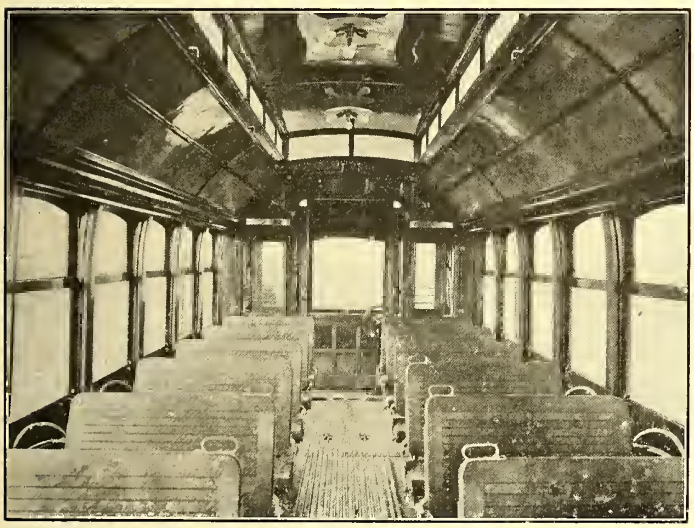


INTER-POLE MOTOR DRIVING RADIAL DRILL IN SHOPS OF THE PHILADELPHIA RAPID TRANSIT COMPANY

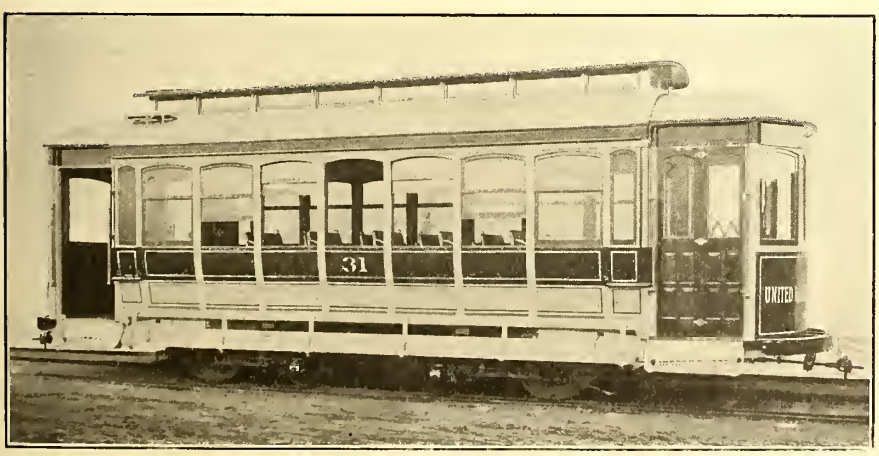
trip, dial depth gage and hand lever reverse. An engraved plate attached to the arm shows the operator how to obtain the proper speeds for different metals and diameters of drills. The depth gage answers a double purpose—besides enabling the operator to read all depths from zero, which does away with the usual delays connected with scaling or calipering, it supplies a convenient means for setting the automatic trip, as the graduations show exactly where each dog should be located in order to disengage the feed at the desired points. The feeding mechanism furnishes eight rates of feed, ranging in geometrical progression from .007 in. to .064 in. per revolution of spindle, each of which is instantly available. The tapping mechanism is located on the head, and permits the backing out of taps at any speed with which the machine is provided, regardless of the speed used in driving them in.

CONVERTIBLE CARS FOR THE UNITED RAILWAYS OF CHATTANOOGA

The United Railways Company, of Chattanooga, has within the last week or so added to its equipment four new cars of the Brill convertible type, built by the American Car Company, of St. Louis. The cars are for use on a line which runs from one of the main streets out to a new residence section which has not built up as rapidly as was expected, and the new cars were purchased with the view of attracting travel in that direction. Pleasure riders will doubtless make much use of the cars because of their comfort and the fine views to be had along the line. R. W. King, the general manager, is well acquainted with the Brill convertible type, as he was formerly with the Newcastle (Pa.) Traction Company, which was among the first to use them. Subsequently he became manager of the Montgomery & Chester (Pa.) Railway Company, and purchased a number of convertibles for that system. He expects at least to double the receipts from the line on which the new cars are operated, and at a cost much less than with the old rolling stock, which consisted of open and closed cars. The company's system connects with the Chattanooga & Lookout Mountain Railway, the Lookout Point Incline Railway and the North Side Consolidated Street Railway, which it owns and has improved. Its lines on the top of Lookout Mountain run to the different points of historical and scenic interest. Chattanooga has a population of over 30,000, and is an important commercial, railway and manufacturing center.

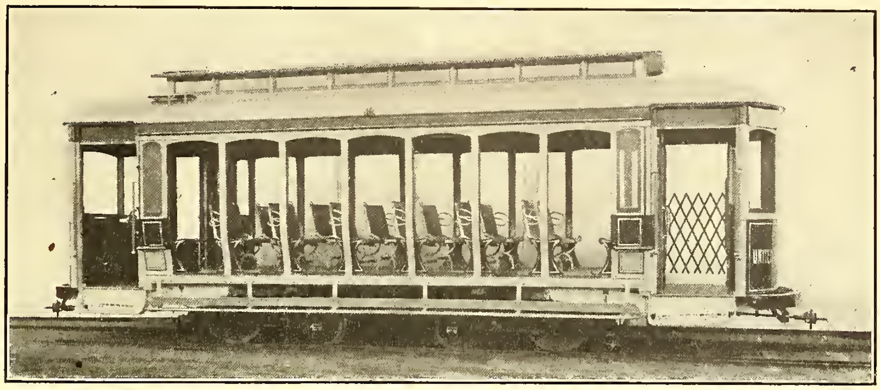


INTERIOR OF CHATTANOOGA CAR READY FOR WINTER SERVICE



ONE OF THE NEW CONVERTIBLE CARS FOR CHATTANOOGA, SHOWING PANELS INSTALLED, BUT WITH PART OF THE WINDOWS RAISED

The cars make a very attractive appearance when open or closed, as will be seen by the accompanying views. The interiors are finished in cherry, with birch headlinings neatly decorated. Step-over back cherry slat seats are of the Brill manufacture. A very interesting feature in connection with these cars is in the fact that, although they measure but 20 ft. 7 ins. over the end panels, they are mounted on double trucks of the "Eureka" maximum-traction type, the reason being that some of the track curves are of shorter radius than would be practical for a single truck with wheel base suitable to this length of car.



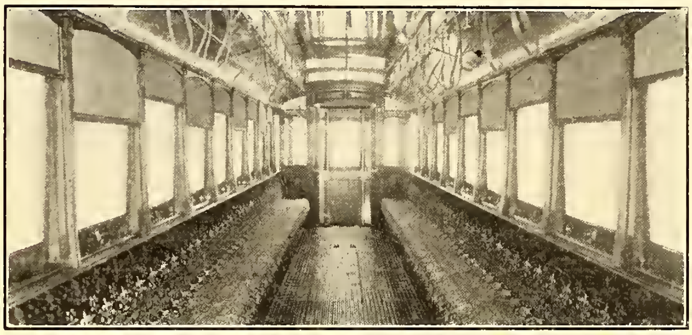
THE CHATTANOOGA CONVERTIBLE CAR READY FOR WARM WEATHER

The general dimensions are as follows: Length over the vestibule sheathing, 30 ft.; width over the sills, 7 ft. $6\frac{1}{2}$ ins.; width over the posts at the belt, 8 ft. 4 ins.; sweep of the posts, $4\frac{3}{4}$ ins.; distance between the centers of the posts, 2 ft. 7 ins.; height from the floor to the ceiling, 8 ft. $6\frac{7}{8}$ ins.; height from the track over the trolley board, 9 ft. $4\frac{3}{4}$ ins.; height from the track to the platform step, $15\frac{3}{4}$ ins.; from the step to the platform, 12 ins.; height from the track to the running board, $18\frac{1}{2}$ ins. The side sills are $3\frac{1}{4}$ ins. x $4\frac{5}{8}$ ins., and the wheel pieces, $5\frac{1}{4}$ ins. x 6 ins. Instead of sill plates, Z-irons are used, the sills resting on the outward extending lower flange. The corner posts are $3\frac{3}{4}$ ins. thick, and the side posts, $3\frac{3}{8}$ ins.; length of the seats, 34 ins.; width of the aisle, 22 ins.; truck wheel base, 4 ft.; diameter of wheels, 33 ins. and 20 ins. The car, with trucks, weighs 17,500 lbs.

Indianapolis is another city in which rebates are given passengers from out of town. In fact, the Merchants' Association of Indianapolis claims to have originated the plan. In that city, on a purchase of $25 worth of merchandise from any one or more of the members of the association, the shopper's fare for 40 miles, coming and going, or a total of 80 miles, is refunded to one traveling on a steam road, or 75 miles each way, or a total of 150 miles, to one traveling via interurban lines. Those living a greater distance than 40 miles or 75 miles may have their fare rebated or refunded for the 80 miles or 150 miles, round trip, leaving only the minimum cost to be prepaid. During the year 1905 the Indianapolis Association paid out a sum equal to $20,000 in rebates to Indianapolis shoppers. About one-fourth of those who apply for rebate books and secure a rebate patronize the steam lines, and three-fourths the interurbans. Ten days are allowed to make the $25 in purchases. The rebate is paid at the association's Indianapolis office.

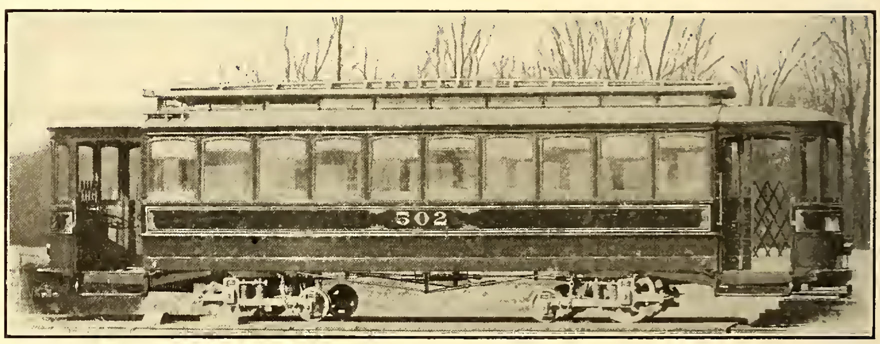
NEW CARS FOR COLUMBUS, OHIO

The Columbus Railway & Light Company has just received ten new cars from the G. C. Kuhlman Car Company, like the one shown in the accompanying illustrations. They are of the standard length used by the company, 28 ft. 8½ ins. The platforms are 6½ ft. long, measured from the end panels over the vestibule sheathing, and have high folding gates, besides folding doors. The trolley boards are trussed to bring the strain chiefly upon the ends of the car. This form of trolley board is used on most of the company's cars. The length over the bumpers is 43 ft. 4⅜ ins.; width over sills, 6 ft. 10 ins.; width over the posts at belt, 7 ft. 11¼ ins.; sweep of posts, 6⅝ ins.; centers of posts, 2 ft. 10 ins.; height from floor to ceiling, 8 ft.



LONGITUDINAL SEATING IN COLUMBUS CAR

1½ ins.; height from track to the under side of sills, 2 ft. 9 ins.; height from under side of sills over trolley board at highest point, 9 ft. 5½ ins. The side sills are 4 ins. x 7½ ins., with 7-in. x ½ in. sill plates on the outside; thickness of corner posts, 3¾ ins., and side posts, 2¼ ins. The cars are mounted on "Eureka" maximum-traction trucks, carrying 40-hp motors, and having 4-ft. wheel base, 33-in. and 20-in. wheels and 4½-in. axles.



DOUBLE-TRUCK CAR FOR THE COLUMBUS RAILWAY & LIGHT COMPANY

Besides being an important steam railroad point, Columbus is the operating center of eight large interurban systems. It has a population of over 125,000 and a large transient population, due to its manufacturing interests and the fact that it is the capital of Ohio. The system of the Columbus Railway & Light Company covers the entire city, the lines radiating in all directions from the city's center, with a total trackage of about 100 miles. In addition to the city system, the company operates a 14½-mile interurban road from Columbus to Westerville. Minerva Park, owned by the company, is on this line, and is 9¼ miles from the center of the city. The lines also reach Oletangy Park, which is operated by the company, and which covers 37 acres of ground. It is situated on a branch of the Scioto River and has a large theater. Both parks are popular and secure a large amount of traffic to the lines which reach them. A number of large cars for the Westerville division were furnished two years ago by the American Car Company. Most of the company's standard 28-ft. closed cars were furnished by the J. G. Brill Company.

During October, November and December the United Railways Company, of St. Louis, carried 44,241,395 passengers and made 1,235,524 trips. In the months of July, August and September there were 44,435,325 passengers carried and 1,269,032 trips made. In 1904, the last quarter of the year, there were 1,537,150 trips made and 53,695,829 passengers carried. In 1905, 170,009,691 passengers were carried, and in 1904, 201,316,532, a falling off of 31,306,842. There was a gain in 1905 over 1903 of 22,868,262.

ELECTRIC RAILWAY AT SHANGHAI

The Shanghai Electric Construction Company, Ltd., of London, has been organized with a capital stock of £320,000, divided into 320 shares of £1,000 each, to construct an electric railway in the foreign settlement at Shanghai. There will be 23⅓ miles of track, of which 6 miles will be double track. The Shanghai Company will pay the authorities 5 per cent of the gross receipts, and has a perpetual franchise, but with the right reserved to the authorities of purchasing the enterprise as a going concern at the end of thirty-five years. Power will be purchased from the municipal lighting plant. The contract for the construction has been let to Bruce Peebles & Company for £277,000. Among those prominently interested are Sir Alfred Dent, of Dent Brothers & Company, London, and Alfred Dent & Company, of Shanghai; R. S. Portheim, managing director of Bruce Peebles & Company; Col. Thys, of La Compagnie Internationale d'Orient, and the Electric Conversion Syndicate, of London. The consulting engineers are Sir Douglas Fox & Partners, and Harper Brothers & Company, of London.

9700-HP HYDRAULIC TURBINE FOR CALIFORNIA GAS & ELECTRIC CORPORATION

An interesting point in connection with the recent purchase by the California Gas & Electric Corporation, San Francisco, of a 9700-hp, single horizontal, spiral case, reaction hydraulic turbine, is contained in the fact that this turbine will operate under a 550-ft. head at a speed of 400 r. p. m., said to be the highest head under which a turbine of this type has ever been installed. Until recently, manufacturers of secondary machinery have avoided the operation of their apparatus on high speeds. This prejudice, however, has, to a great extent, been overcome, and it is only a question of time when this type of hydraulic turbine will be constructed for still higher heads than the present practice will allow. This turbine and accessories will be furnished by the Allis-Chalmers Company, of Milwaukee, and is destined for installation at Chico, Cal.

The entertainment given to the employees of the Brooklyn Rapid Transit Company by the Brooklyn Rapid Transit Employees' Association at the clubhouse of the association in East New York was concluded on Saturday evening of last week. George W. Edwards, the secretary of the association, said that at each performance the hall was well filled, and that on Thursday evening, which was officers' night, the attendance was very large. At the Saturday matinee a novelty was introduced in the distribution to the little girls present of some thirty dolls. There was on the bill a sketch in which was introduced a baby, and advantage was taken of this to dispose of the products of the "farm." On Saturday evening Newton W. Bolen, superintendent of transportation of the Public Service Corporation of New Jersey, and several of his associates in that company were the guests of the Brooklyn Association.

FINANCIAL INTELLIGENCE

Wall Street, Jan. 24, 1906.

The Money Market

There has been a further material improvement in the monetary situation during the past week. Not only have rates for all classes of accommodations been forced to a lower level, but the offerings of funds at the new quotations have been considerably larger than at any time for several months past. The volume of business also has been larger, particularly in the time loan branch, many of the maturing contracts having been renewed at the current quotations. The easier conditions prevailing in the local market were due almost entirely to the continued heavy arrivals of funds from the interior and by further substantial gains in cash by the local institutions on their operations with the Sub-Treasury. The position of the Clearing House banks is now stronger than for a long time, and while the influx of funds from out-of-town sources is likely to continue for some weeks to come, it is not expected that rates will go much below the present level so long as the stock market maintains its present activity and strength. During the week moderate amounts of gold have been shipped to Mexico and to South America, and further shipments of the precious metal may be expected in the near future. Foreign exchange has ruled decidedly firm throughout the week, but gold exports to Paris have again been averted by a further advance in the Paris checque rate on London. The European markets have been somewhat easier, discounts at all the principal financial centers being quoted slightly below those prevailing at the close a week ago, as evidenced by the action of the Imperial Bank of Germany in reducing its official discount rate, and similar action is expected to be taken by the Bank of England later in the week. The statement of the associated banks published on last Saturday made another extremely favorable exhibit. The increase in cash amounted to $11,996,700. The reserve required was $8,040,775 larger than in the preceding week, resulting in an increase in the surplus of $3,955,925. Loans increased $20,553,900 and deposits increased $32,163,100. The surplus reserve on Jan. 20 last was $16,764,475, as against $12,808,650 in the previous week, $23,733,800 in the corresponding week of last year, and $26,072,675 in 1904.

Money on call has loaned at 6 and 3½ per cent during the week, the average rate being 4½ per cent. Money for sixty days to six months was obtainable in quantity at 4¾ per cent, as against 5 to 5¼ per cent in the week preceding. Commercial paper was easier, prime endorsements being discounted at 4¾ per cent.

The Stock Market

The past week in the stock market has witnessed periods of reaction, some of which have been quite pronounced. These had resulted in the main from selling on the part of pools which had previously bought stocks heavily at materially lower prices than those now current, although selling by operators for the fall contributed not a little to the declines reported. There is more than a suspicion that some of the larger interests liquidated a portion of their holdings, presumably for the purpose of preventing the market from developing into a runaway affair, such as it threatened to do at intervals. It must be said, however, that the combined selling movement noted served only to demonstrate more clearly than ever, perhaps, the great power of absorption which the present stock market possesses. This naturally leads to the conclusion that the public is in the market to a much greater extent than at any time for a year or more past, and that, despite the decided advance in prices of late, is convinced that values are still in line for further improvement. This reasoning would appear to be perfectly sound, as practically all the elements that go to make up a big bull market are now strongly in evidence. The money market, both here and abroad, has returned to a normal condition, and from all indications will remain in that state permanently. The exceptionally open winter has greatly benefited many lines of industry, more particularly the transportation companies, and this is bound to be reflected in increased earnings, as well as in a considerable reduction in operating expenses, consequent upon the lack of the usual severe snowstorms. In only one industry, perhaps, that of copper, has there been any evidence of a reaction, the week having developed quite a decline in prices from the recent very high level. In this instance the reactionary tendency resulted from selling of speculative holdings of copper metal, and did not by any means indicate the beginning of a permanent downward move in the market for that product. However, the bears in the stock market made use of this as a subterfuge, and at one time made a sharp drive against the stock of the Amalgamated Copper Company, which it was plain to be seen was done for no other purpose than to influence adversely the balance of the list. It is safe to say that the copper metal industry is sound in every particular, otherwise the directors of the Amalgamated Copper Company would not have placed the stock upon a permanent 6 per cent dividend basis, which they did during the week by declaring 1½ per cent for the quarter. Notwithstanding the reactionary tendency spoken of in the stock market, many issues scored very considerable advances in response to the several encouraging factors referred to, which were supplemented by the favorable result of the English elections and by a belief that nothing harmful was likely to come from the conference of the Powers regarding Morocco. Not the least important among the stocks which reported decided advances was Reading. However, the sensational rise in this stock created fears of a corner in it, and its influence was rather against an improvement in the general list. Other notably strong features included St. Paul, Colorado Fuel, Southern Pacific, Federal Mining & Smelting, National Lead, American Smelting, Anaconda, American Linseed, Atlantic Coast Line, Great Northern preferred, the Pacific Coast issues, some of the Gould properties and the United States Steel stocks.

The only thing new in connection with the local traction stocks during the week was in the nature of a report of some new terms to govern the proposed merger of the Belmont-Ryan companies. The fact that there was no substantiation of this report, and that official announcement of the details of the new plan were withheld, acted as somewhat of a deterrent to an active speculation in the chares of the local traction companies and, comparatively speaking, dealings in them were smaller than of late and fluctuations in prices narrower. It must be said in connection with these companies, however, that their earnings at present are piling up in an unprecedented manner. Moreover, all of them are being benefited in an exceptional degree by the extreme mildness of the weather. All of this, in the ordinary nature of events, is bound to be reflected sooner or later in the prices for these securities.

Philadelphia

Increased activity characterized the market for the local traction issues during the past week, and although prices displayed more or less irregularity as a result of profit taking, the general trend of values was toward a higher level. A conspicuous feature of the dealings was an advance in Consolidated Traction of New Jersey stock, the price making a net gain of 2 points to 82½, the highest price recorded in several months. Upwards of 800 shares were dealt in. Other strong issues included Union Traction, which rose ¾ to 63½ on the purchase of about 1500 shares, and Fairmount Park Transportation, which moved up a point further to 20. American Railways was comparatively quiet but decidedly strong, about 600 shares changing hands at from 52½ to 53⅞, a net gain of 1⅞. Philadelphia Rapid Transit was the active leader of the list, upwards of 20,000 shares of the stock changing hands. During the early part of the week the stock was under pressure, the price receding from 32¾ to 32½, but subsequently there was renewed buying by the New York interests which lifted the stock to 33⅜. Commission houses were also free buyers. Near the close there was some profit taking and a reaction to 32¾ resulted. Philadelphia Company was active and strong, about 18,000 shares changing hands at prices ranging from 53⅞ to 53⅛. Small amounts of the preferred brought 50½ and 51. Rochester Railway & Light advanced 3 points to 100 on the purchase of 10 shares. Other transactions included Railways General at 7 and 7⅛, Union Traction of Pittsburg preferred at 51, Second & Third Street Passenger at 300½, Thirteenth & Fifteenth Street Passenger at 301½, United Companies of New Jersey at 269¼, and Philadelphia Traction at from 101⅛ to 101½, an advance of ½ point.

Baltimore

Trading in tractions at Baltimore continued active, with United Railway issues again constituting the leading feature. In the early dealings the stocks and bonds of this company displayed moderate activity and firmness, but later on the announcement that the deal was premature caused rather heavy liquidation, which was reflected in materially lower prices. Of the 4 per cent bonds, about $100,000 changed hands at from 94⅛ to 94. The free incomes, after selling at 70¼ at the opening ran off to 69 and closed at 69½ on the exchange of nearly $500,000 bonds, while the pooled incomes, after rising from 68 to 69, reacted and closed at 68⅛. Transactions in the latter aggregated about $375,000. Both the free and pooled stocks were considerably less animated, about 2500 of the first named selling at 16 to 16½ and back to 16¼, while upwards of 11,000 of the deposited stock changed hands at from 18 to 17 and back to 17⅝. Washington City & Suburban 5s were conspicuously strong, $10,000 selling at 112¾ and 113, an advance of 1¾. Other sales were: $19,000 Norfolk Railway & Light 5s, at 97½; $5,000 Richmond Traction 5s, at 105½; $3,000 Macon Railway & Light 5s, at 99½ to 99¾; $1,000 Atlanta Street Railway 5s, at 105½; $4,000 Virginia Railway & Development 5s, at 99½, and $5,000 Charleston Consolidated Electric 5s, at 97¼.

Other Traction Securities

Intense dullness prevailed in the market for street railway issues at Chicago. Trading was confined largely to odd lots and price changes were unimportant. Transactions included Chicago City Railway at 199, North Chicago at 80, West Chicago at 51 and 50, Metropolitan Elevated common at 28, Chicago & Oak Park common at 7⅜ to 7¾, the preferred at 28 to 28¼, and South Side elevated at 96. The Boston market was fairly active and generally strong. Boston Elevated, after selling at 160 at the opening, declined to 157½ and later recovered to 159, a net gain of a point Massachusetts Electric issues, although somewhat less animated than in the previous week, were strong, about 2000 shares of the common bringing 18¼ to 19¼, while about 1500 of the preferred sold at prices ranging from 67¾ to 69½ and back to 68½. Other transactions were: Boston & Suburban common at 20, the preferred at 65; Boston & Worcester common, from 25 to 28, the preferred at 72½ to 74½; West End common at 100 to 99, and the preferred at 114⅛ and 114. In the New York Curb market, Interborough Rapid Transit developed considerable activity, upwards of 14,000 shares being dealt in. From 235 at the opening, the price dropped to 230¾ on moderate selling, but subsequently there was a sharp advance to 236. At the close there was a reaction to 234¾. The new common stock to be issued by the Interborough-Metropolitan Company was also actively traded in, when issued about 8000 shares in all changing hands. At the opening the delay in announcing the details of the merger caused some selling, which carried the price from 59 to 53, but later, upon a report that holders of Interborough and Metropolitan stocks would be offered a larger amount of common stock in the new company, the price advanced to 60. The final transaction was made at 57¾. Of the new preferred stock, 400 shares sold at 98½ and 99, while upwards of $425,000 of the new 4½ per cent bonds brought prices ranging from 95⅜ to 95. New Orleans Railway common sold at 39½ and the preferred at 85, while $23,000 of the 4½ per cent bonds brought 91¼ to 91¾. Washington Railway common sold at 41¾ and 41, while the preferred changed hands at 87½ to 87.

Security Quotations

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

	Jan. 17	Jan. 24
American Railways	52½	53¾
Boston Elevated	158	159
Brooklyn Rapid Transit	90¾	91¼
Chicago City	197¾	—
Chicago Union Traction (common)	10	10⅞
Chicago Union Traction (preferred)	40	—
Cleveland Electric	83	83½
Consolidated Traction of New Jersey	81	82
Consolidated Traction of New Jersey 5s	107½	107½
Detroit United	94⅜	97½
Interborough Rapid Transit	234	234½
Interborough-Metropolitan Co. (common), W. I.	57½	55½
Interborough-Metropolitan Co. (preferred), W. I.	98½	97½
Interborough-Metropolitan Co. 4½s, W. I.	95	94½
International Traction (common)	37	37
International Traction (preferred) 4s	75	75
Manhattan Railway	160	160½
Massachusetts Electric Cos. (common)	18½	18¾
Massachusetts Electric Cos. (preferred)	69	68
Metropolitan Elevated, Chicago (common)	28	—
Metropolitan Elevated, Chicago (preferred)	71	—
Metropolitan Street	126½	124¼
Metropolitan Securities	74⅝	71¾
New Orleans Railways (common)	39	39½
New Orleans Railways (preferred)	85½	85
New Orleans Railways, 4½s	91	91¼
North American	101⅝	103⅜
North Jersey Street Railway	25	25
Philadelphia Company (common)	53⅜	53⅛
Philadelphia Rapid Transit	32½	32½
Philadelphia Traction	101	101½
Public Service Corporation 5 per cent notes	95½	95
Public Service Corporation certificates	70	70
South Side Elevated (Chicago)	96	—
Third Avenue	138	138
Twin City, Minneapolis (common)	119	119¾
Union Traction (Philadelphia)	63	63⅝
West End (common)	99	99
West End (preferred)	113	113

W. I., when issued.

Iron and Steel

The "Iron Age" says the open winter thus far has encouraged consumption and has kept it at an enormous rate. The pressure for prompt deliveries continues, and it is only old material which has suffered, since scrap is coming out much more freely than it ordinarily does at this season of the year. Despite a strenuous effort to maintain values, old material is weak. Negotiations are reported as pending between valley makers and the Steel Corporation for a large tonnage of pig iron for the second quarter, the requirements not having been covered as yet. In the East steel makers are urging shipments. Founders are in the market constantly, but it is a noteworthy fact that the Southern producers are not as firm as they have been and that increasing quantities of Southern iron are available at $14 at Birmingham for No. 2.

UNITED TRACTION FORMALLY TRANSFERRED

Control of the United Traction Company, of Albany, formally passed to the Delaware & Hudson Railroad at a meeting held in Albany last week. The directors and the officers all resigned, and a new board and new officers were chosen. The new board of directors is composed of David Wilcox, of New York City, who is president of the Delaware & Hudson Company; Abel I. Culver, second vice-president of Delaware & Hudson Company; W. J. Mullin, assistant to the second vice-president; T. B. Dixey, assistant to the second vice-president; Lewis E. Carr, attorney of the Delaware & Hudson Company; Alex Ekstrom, consulting electrical engineer of the Delaware & Hudson Company; Charles H. Sabin, vice-president of the National Commercial Bank, of Albany; James F. McElroy, president of the Albany Chamber of Commerce, and J. H. Caldwell, president of the Troy Chamber of Commerce. The new officers are: David Wilcox, president; Abel I. Culver, vice-president; Abel I. Culver, chairman, and W. J. Mullin and Alex Ekstrom, associate members of the executive committee. The directors who retired are: A. Bleecker Banks, Anthony N. Brady, Thomas Breslin, Charles Gibson, Albert Hessberg, George P. Ide, William Kemp, Francis N. Mann, Jr., James H. Manning, William McEwan, John W. McNamara, Edward Murphy, second; James O'Neill and Robert C. Pruyn.

The directors organized by electing the new executive committee and new officers as given above. The membership of the board was reduced to nine, and that of the executive committee to three. Abel I. Culver will direct the policies of the road under its new management.

The Delaware & Hudson Company has called a meeting of stockholders for Feb. 19, to consider increasing the capital stock by $7,000,000, in 70,000 shares of the par value of $100 each. The stock issue is to take up a proposed issue of $14,000,000 of 4 per cent ten-year debentures, to be offered to the stockholders pro rata at par. The exchange is to be made at the rate of five shares of stock for each $1,000 debenture, and within five years of the date of the debenture. In an official statement it was announced that the proceeds of the forthcoming issue will be used for the following purposes:

Ten million dollars for the cost of the United Traction Company, of Albany, and a half interest in the Schenectady Railroad Company.

Two million four hundred thousand dollars for new equipment.

One million six hundred thousand dollars for the construction of a cut-off around Wilkesbarre, Pa., to overcome the difficulties of congested tracks and high grades under which business now received from the Pennsylvania Railroad at South Wilkesbarre is now being handled.

ALLIANCE AGAINST ACCIDENT FRAUD

In the Nov. 4 issue of the STREET RAILWAY JOURNAL a notice was published of the preliminary organization in New York on Oct. 25 of an association of street railway, steam railroad and other transportation companies and casualty companies against barratry, unfounded and exaggerated claims for injuries and fake accident cases in general. At that meeting a committee was appointed to consider the subject. This committee was composed of the following: Edson S. Lott, chairman, general manager, United States Casualty Company, New York; James L. Quackenbush, general attorney, New York City Railway Company, New York; Charles C. Paulding, attorney, New York Central & Hudson River Railroad Company, New York; Russel A. Sears, attorney, Boston Elevated Railway Company, Boston; Robert B. Armstrong, president, Casualty Company of America, New York. The secretary was Chauncy S. S. Miller, secretary, Casualty Company of America, New York.

On Jan. 8 a circular was issued by this committee, stating that a second meeting would be held at the Hotel Astor, New York, on Jan. 17, for the purpose of forming a permanent organization, and inviting the attendance of all interested in the subject. The circular stated that the object of the alliance would be "to protect and defend its members against fraudulent claims; to prosecute all persons engaged in presenting and promoting such claims; to collect and disseminate information to its members concerning fake claimants, shyster lawyers, unprincipled physicians, ambulance chasers, false witnesses and others engaged in such practices; to insist upon fair dealing with honest claimants, and, generally, to impress upon the public these principles." It was also voted that the membership be limited to such casualty and liability insurance companies, common carriers, public service companies, large employers of labor and others as shall be approved by the committee on membership.

Among those who responded to the roll call at the meeting on Jan. 17 were: Robert B. Armstrong and Chauncy S. S. Miller, president and secretary, respectively, of the Casualty Company of America; Edson S. Lott, general manager, United States Casualty Company; R. S. Sears, Boston Elevated Railway; R. C. Richards, Chicago & Northwestern Railroad; C. C. Paulding, New York Central Railroad; F. J. Moore, General Accident Corporation, Philadelphia; J. L. Quackenbush, New York City Railway; J. B. Lackey, secretary, Washington (D. C.) Railway & Electric Company; James R. Pratt, acting general manager, United Railway & Electric Company, of Baltimore; W. C. Wilson, Delaware, Lackawanna & Western Railroad; Robert Walker, Chicago, Rock Island & Pacific Railroad; H. V. Drown, the Rhode Island Company, Providence, R. I.; J. G. M. Hamilton, Atchison, Topeka & Santa Fe Railroad; James J. Cagney, Montreal Light, Heat & Power Company; L. L. Gilbert, Pennsylvania Railroad lines west of Pittsburg, of Pittsburg; Jackson E. Reynolds, Central Railroad of New Jersey; George D. Yeomans, Brooklyn Rapid Transit Company; C. B. Orcutt, Hudson River Day Line. Proxies for several express companies, steam railroad and traction companies were handed in, and applications for membership from some half dozen others arrived too late for action by the committee.

The committee on legislation, of which Mr. Sears is the chairman, reported at its meeting early in the day that copies of the bills to stop barratry have been introduced by the Alliance into the Legislatures of Massachusetts, Maryland and other States, and that it had been unanimously decided to have a similar measure introduced into Congress as soon as it could be drafted.

The secretary read the bill that has been introduced in Massachusetts, which reads as follows:

An Act to Prevent the Malicious Promotion of Litigious Claims.

Be it enacted by the Senate and House of Representatives in general court assembled, and by the authority of the same, as follows:

Section 1. Whoever, for his own gain, and having no existing relationship or interest in the issue, directly or indirectly, solicits another to sue at law or in equity, or to make a litigious claim, or to retain his own or another's services in so suing or making a litigious claim, or whoever, being an attorney-at-law, knowingly prosecutes a case in which his services have been retained as a result of such solicitation, or whoever, being an attorney-at-law, directly or indirectly, agrees to procure another to be employed in consideration of his soliciting litigious business, or undertaking to solicit it, or in any other way compensates or agrees to compensate another for so doing, shall be punished by a fine of not more than five hundred dollars ($500), or by imprisonment for not more than three months, or by both.

Section 2. This act shall take effect upon its passage.

The report of the treasurer was presented and accepted, and showed that the organization has a large unexpended balance on hand with which to prosecute its aim. It was reported that steps are now to be taken to give full publicity to the conviction and imprisonment in Missouri of an attorney named Johnson, who had committed barratry, and of the report in the official series of the Supreme Court of New York State, reported Jan. 13, wherein an attorney named Clark, of Buffalo, was held subject to disbarment by reason of having entered into an arrangement with a man in the same city whereby he, Clark, was to solicit telephone and telegraph cases.

The committee on medical associations outlined the steps that are being taken to have reputable physicians punished and suspended from membership in the local and national medical associations when their complicity in litigious and fraudulent claims has been made clear.

Mr. Quackenbush, the chairman of the committee on bar associations, reported that he had conferred with the chairman of the grievance committee of the city of New York, to whom charges against a certain lawyer of this city, recently committed for perjury, had been made, the man being sent to prison for seven years, and the entire credit for this action was given to the Alliance Against Accident Fraud.

The permanent officers elected were: President, Russel A. Sears, attorney, Boston Elevated Railway Company; first vice-president, James R. Pratt, attorney, United Railways & Electric Company, Baltimore; secretary and treasurer, Chauncy S. S. Miller, secretary, Casualty Company of America, 52 William Street, New York. It was also decided to appoint a vice-president to represent every State, Territory and country, except those represented by the president and first vice-president, in which the Alliance has a subscriber or subscribers. These vice-presidents will be in charge of the work of the association in each State. Those already elected are as follows: New York, Edson S. Lott, United States Casualty Company of New York; New Jersey, Jackson E. Reynolds, C. R. R. of N. J.; Illinois, Robert Walker, C., R. I. & P. R. R.; Rhode Island, H. B. Drown, the Rhode Island Company; Kansas, J. D. N. Hamilton, A., T. & S. Fe R. R.; District of Columbia, James B. Lackey, Washington Railway & Electric Company; Canada, J. J. Cagney, Montreal Light, Heat & Power Company. The executive committee was given power to add to this list of vice-presidents.

It was decided to hold the annual meeting the third Wednesday in January, and to charge an initiation fee of $100 and annual dues of $100.

It was also decided to establish a central bureau from which information as to all such claims will be distributed to the members of the Alliance. A card index will be kept of such reports, and if the same person has at any time made a claim against any other member, the fact will be reported. The same plan will be followed in relation to doctors, lawyers, ambulance chasers or runners, witnesses and others. The Alliance will have permanent committees upon bar associations, medical associations and legislation, to call to the attention of reputable lawyers and doctors the improper practices of their fellows and to try to bring about such legislation as may tend to defeat the crooks. Such committees are to be made up from the membership, and the members are to serve without pay.

In accepting election as president, Mr. Sears said, in part: "We have begun in the right fashion, and when one casts his eye over the list of corporations which are met here to-day, it is imposing and impressive when we consider what it means, and will undoubtedly bear fruit with the public. I believe the theory we are practicing now is that this national bureau should be the center point from which branches shall reach out—that the local organizations will have platforms on the plans of the Boston organization. There we have every public service and corporation, every transportation company, gas company, casualty company, accident company and great employees of labor all banded together. We have what we call a common index, which goes by the name of the Index Bureau, to which we all subscribe. Each one of us sends to that bureau every day the list of claimants on our respective records. We have this month 50,000 names for that card index, and without doubt in the next six months we shall have card indexed more than 100,000 names of persons who have had claims against our respective companies.

"It will then be almost impossible for any man to run that gauntlet with the same name, for the cards contain the name of the claimant, any alias he may have used, his physician's name, date and place of the alleged accident, and the attorney representing him, together with some short abstract of the claim and the name of the company sending the report. * * * The action is automatic. Where I have had to go round and inquire of the various railroads, public service corporations and large employers whether some John Smith ever had a claim before, it has taken a long time and has consumed a lot of energy; whereas in this way the information is already collated and the system is as nearly automatic as it can be.

"It has been demonstrated that localities never before dreamed of as harboring claimants, of involving claims and claiming damages, have been brought to light. We have had as many as nine claims from one house. Again, I may say that the aliases covered are a great help. The man making a claim may be John Smith, of

38 Washington Street, but the card index will develop the fact that his name is William Smith, and that he lived at another location."

Mr. Sears went on to illustrate how the same system was followed with regard to physicians who make a practice of giving testimony for the alleged victims of street accidents, and that the information supplied through the Central Bureau indices was proving of great value in the cross-examination of witnesses. He concluded by saying: "It will exercise great weight before our Bar Association that all you men met here to-day, representing so many interests and such wide influences, have indorsed this barratry bill. * * * Our Bar Association, I am glad to say, is composed of reputable lawyers, and they want to see the old confidence restored as fast as it can be, and such action as we have taken here to-day cannot help but be of benefit all over the country."

Among the street railway companies which have joined the Alliance are the Boston Elevated Railway Company; Philadelphia Rapid Transit Company; Boston & Northern Street Railway Company; Brooklyn Rapid Transit Company; United Railways & Electric Company, Baltimore; Washington Railway & Electric Company; Public Service Corporation of New Jersey; New Hampshire Electric Railways Company, and the Boston & Suburban Electric Companies.

IMPORTANT BILLS IN MASSACHUSETTS

The special recess committee on railroad and street railway laws of the Massachusetts Legislature, appointed a year ago, has decided to recommend to the Legislature the passage of a law to permit street railways and railroads to consolidate after the approval of the Railroad Commissioners has been granted. This practically put the whole matter into the hands of the Railroad Commission, and is exactly in line with all the other railway and railroad legislation passed in Massachusetts in recent years. In all other matters concerning the construction and development of street railway systems, the law requires primary action before local authorities as a matter of course; but power of approval and vistual control rests with the Railroad Commission, which is the State board. It is worth noting, too, that the Legislature has shown no disposition whatever since starting out on this policy to divide or restrict the authority of the board; but, on the other hand, has given it constantly more and more power.

Another feature of the special committee's recommendations is the extension in limited form of the power of street railway companies to take land by right of eminent domain. This is a direct concession to the movement for interurban lines and high-speed service, which has come into Massachusetts very slowly, owing to the strict laws and the thickly settled territory that has to be traversed even by new lines. Some time ago the Railroad Commissioners, after having the matter brought up at repeated hearings, ruled that it had authority under the law to approve deviations from established highways, so far as street railway locations were concerned, only when it was shown that such deviations were necessary for the avoidance of dangerous curves or grades. That is, they could not approve of locations on private land merely for the sake of enabling the road to obtain a straighter line, and therefore provide for higher speed. This recommendation, it is expected, will meet the difficulty involved here, and a law following the committee's suggestion will undoubtedly pave the way for a considerably freer development of interurban schemes than has hitherto been possible.

The time for introducing new business under the rules in the Legislature closed Saturday, Jan. 20, and it may therefore be assumed that practically all the new bills concerning railways are now in hand, except such as may later prove of sufficient importance to induce a suspension of rules to allow their admission. It may be worth noting that a measure has been introduced which would give to cities and towns, under certain conditions, the right to acquire, lease, own, operate and maintain street railways.

The main arguments may be summed up as follows:

In connection with the plan to authorize the merger of the steam railroads and the electric railways, it is of interest to note the arguments advanced in support of the respective issues.

THE STEAM RAILROAD POSITION

1. The merger policy brings into the management of the street railway that special ability and knowledge which come from long experience in dealing with transportation problems, and, as well, greater financial resources.

2. The financial embarrassment of certain lines would be relieved by having these enterprises in more conservative and experienced hands.

3. The street railways are largely steam railroad feeders. They bring people to the railroad from the different sections of the town which it serves, and distribute them again at the end of the journey. Joint management of the two would enable them to perform this service more efficiently and harmoniously.

4. The policy of the State as regards transportation is monopoly with public regulation. Competition in this service has always proved wasteful and destructive; the best policy is to allow and protect a complete but regulated monopoly. If the established policy of monopoly is to be exchanged for one of competition, then all restrictions should be removed and the steam railroads allowed to compete on an equal footing.

5. The Boston & Maine Railroad has made a very effective point of the fact that the New York, New Haven & Hartford Railroad already controls street railways in Massachusetts. It asks to be allowed, as a domestic corporation, the same rights which a foreign corporation already asserts.

THE ANTI-MERGER SIDE

1. Monopoly ought by no means to be allowed until the "development period" in selective transportation is over; until the electric railways are giving the genuine interurban rapid transit and light freight service which is so much needed.

2. The steam railroads, in control of the situation, will not bring about this development. Their investment is so tied up in steam equipment that it is not reasonable to suppose that they will make incursions into the field of electric railroading except under heavy pressure. Moreover, the necessity of avoiding any violent fluctuations in their securities makes it inexpedient for them to undertake any new thing involving any considerable amount of risk. It was one manifest purpose of the New York, New Haven & Hartford Railroad in buying up Connecticut electric railways to head off electric communication between New York and Boston. The Boston & Maine Railroad might adopt the same view with reference to an electric road between Boston and Portland, Maine.

3. The policy of consolidation in steam transportation has been disadvantageous to the State and has resulted in comparatively poor passenger service. Where competition has actually developed, it has resulted in lower fares, greater convenience and comfort to travelers, more frequent service and increased travel, to the great benefit of the public, and without serious loss to the steam roads themselves. Competition is ruinous only where it involves unnecessary duplication in equipment, and two different kinds of transportation, touching at the same points, may well incite each other to adequate development, the maximum of service and the minimum of charge, and a healthy spirit of enterprise, without that resulting damage to the public interests which follows direct competition on parallel lines between public service corporations rendering identical service.

4. The New Haven road is really in the same category as the Boston & Maine, both holding Massachusetts charters. In view of the doubts expressed as regards the legality of the present New Haven control, haste should not be taken to place the Boston & Maine in the same position.

5. The State cannot afford as yet to declare itself in favor of a policy of monopoly in this matter even though common control can be secured in any case by stock purchase, for such a declaration of policy would doubtless be used by the steam railroads in opposition to the granting of new electric railway charters, and would lessen that influence which otherwise might be exerted to secure better service on the steam railroads themselves.

AURORA, ELGIN & CHICAGO RAILWAY ORDERS NEW CARS

The Aurora, Elgin & Chicago Railway Company has placed with the Niles Car & Manufacturing Company an order for ten passenger cars. The new cars will be somewhat longer than those now in service on the road, and the seats will be spaced farther apart. The cars will be equipped with the Sprague-General Electric multiple-unit control.

PHILIPPINE CONTRACT TO J. G. WHITE & COMPANY

Secretary of War Taft has recommended to the Philippine Commission the acceptance of the bid for the construction of steam railroads in the Philippines by J. G. White & Company and associates. These bids covered 100 miles from Iloilo to Bataan; 100 miles from Escalante to Jumaymayalan, and 95 miles from Cebu to Danao. All of the lines will be of narrow-gage, single-track construction.

NEW MERGER PLAN FOR NEW YORK COMPANIES—NEW COMPANY INCORPORATED

A change has been made in the proposed Interborough-Metropolitan Street Railway merger. The terms offered on Dec. 27 for an exchange of the outstanding securities were:

To replace $35,000,000 Interborough stock—	
New 4½ per cent bonds	$70,000,000
New common stock	31,500,000
To replace $52,000,000 7 per cent guaranteed Metropolitan Street Railway stock—	
New 5 per cent cumulative preferred stock	52,000,000
New common stock	26,000,000
To replace $30,000,000 Metropolitan Securities stock—	
New common stock	25,550,000

According to the new plan, announced with apparent authority, the new holding company now offers the following:

To replace $35,000,000 Interborough stock—	
New 4½ per cent bonds	$70,000,000
New common stock	34,650,000
To replace $52,000,000 7 per cent guaranteed Metropolitan Street Railway stock—	
New 5 per cent cumulative preferred stock	52,000,000
New common stock	28,600,000
To replace $30,000,000 Metropolitan Securities stock—	
New common stock	27,900,000

With the filing of the incorporation certificate at the office of the Secretary of State in Albany on Wednesday, Jan. 24, the Metropolitan Street Railway Company and the Interborough Rapid Transit Company took the first official step toward consolidation. The new corporation, the objects of which are set forth at length, is a holding corporation called the Interborough-Metropolitan Company. Its capital stock is $15,000, composed of fifty shares of preferred and 100 shares of common stock. The articles provide that the life of this holding company shall be 1000 years. The directors of the company are John B. McDonald, Walter G. Oakman, James Jourdan, Morton F. Plant and Peter A. B. Widener.

The purposes of the new company, as set forth in the certificate of incorporation are:

(a) To subscribe for, purchase, acquire in any manner, hold as investment and dispose of, bonds and other evidences of, indebtedness of, and the indebtedness of, and shares of capital stock of, or any interest in shares of capital stock of, any corporation engaged in or holding the shares of stock of any corporation or corporations engaged in the transportation of passengers in the city of New York or its suburbs or territory adjacent thereto, or of any other corporation, domestic or foreign;

(b) To aid financially and otherwise any corporation engaged in the transportation of passengers in the city of New York or its suburbs or territory adjacent thereto, and whether in the extension of the lines of such corporation and in their operation or otherwise, and to aid in the formation, organization and operation of other corporations in which the corporation may be or become interested as the holder of shares of stock or otherwise;

(c) To make provision, either directly by the purchase, leasing, and improvement of real estate, or indirectly by the acquisition of capital stock of other corporations.

(d) To do each and every thing necessary, suitable, desirable or proper for the accomplishment of any of the purposes hereinbefore enumerated, to the same extent as a natural person might do as principal, agent, contractor, or otherwise, either alone or associated with other corporations or natural persons, and to receive and exercise all the rights, powers and privileges of natural persons in connection therewith.

Article III. of the certificate tells thus the privileges of the preferred stock:

The holders of the preferred stock shall be entitled to receive from the surplus or net profits of the corporation dividends from the first day of April, 1906, at the rate of 5 per cent per annum and no more, payable quarterly on the first days of January, April, July and October in each year, without deduction for any tax or taxes which the corporation may be required to pay thereon, or to deduct or retain therefrom, under any present or future law of the United States or any State, county or municipality therein. The dividends on the preferred stock shall be cumulative and shall be payable before any dividend on the common stock shall be paid or set apart, so that if in any quarter year a dividend amounting to 1¼ per cent shall not have been paid on the preferred stock, the deficiency, with interest, shall be payable before any dividend shall be paid upon or set apart for the common stock.

Whenever all cumulative dividends upon the preferred stock, with interest as aforesaid, shall have been paid, the board of directors may declare dividends on the common stock, payable out of the then remaining surplus or net profits.

In the event of any liquidation or winding up (whether voluntary or involuntary) of the corporation, the holders of the preferred stock (before any amount shall be paid to the holders of the common stock) shall be entitled to be paid in full the par amount of their shares and interest thereon at the rate of 5 per cent per annum from the date of such liquidation or dissolution or winding up, the unpaid dividends accrued on their said shares until said date, with interest on such dividends at said rate from the respective times at which the same accrued, and the proportionate part of the dividend accruing at said date, with interest thereon at said rate from said date. After such payment in full to the holders of the preferred stock the holders of the common stock shall be entitled to receive the remaining assets and funds in proportion to the shares held by them respectively.

The power to fix the amount to be reserved as a working capital for the corporation is given to the board of directors, and all rights to dividends from profits shall be subject thereto.

The corporation cannot create or issue stock having rights in priority to the rights of the preferred stock; nor, without the consent of the holders of two-thirds in amount of the entire preferred stock at the time issued and outstanding, can the amount of the preferred stock be increased.

The certificate provides that as long as dividends at the rate of 5 per cent a year are paid on the preferred stock no voting power shall be vested in the holders thereof, but if there is ever any default in the payment of dividends they shall have full voting rights. If, however, the directors so request, the holders of preferred stock may cast votes in proportion to their holdings.

The directors will designate an executive committee to exercise between directors' meeting the powers of the board in the management and business of the corporation. The directors are empowered to decide when and to what extent the books of the corporation or any one of them, except the stock book, shall be open to inspection of stockholders. No stockholder shall have the right to inspect any books or documents except as he is empowered to do so by the statutes of the State or by the board of directors.

In behalf of the Interborough-Metropolitan Company directors it was said on Wednesday that the present earnings were sufficient to meet the interest on the $70,000,000 4½per cent bonds that will be issued. The 5 per cent dividend on the new cumulative preferred stock, they say, can also be paid out of present earnings, and there will still be left revenue for dividends on the common stock of the consolidated company. The Metropolitan Street Railway Company, the officials said, is now earning at the rate of 6 per cent on its capital stock, while the Interborough is earnings from 12 per cent to 14 per cent on its $35,000,000 capital stock, after the 7 per cent guaranteed dividend on Manhattan Elevated stock is deducted. Since Jan. 1 the gross earnings of the Interborough Company have increased more than 10 per cent. It was stated that the Interborough-Metropolitan Company is now prepared to accept any fair offer for new subways. It is willing to proceed at once to construct and operate the Lexington Avenue subway extension from Forty-Second Street north, and the subway extension down the west side of town from Times Square to the Battery. The company wants to build a third track on the Third Avenue elevated. The Interborough has been wanting to do this a long time.

The managers of the new company think that the congestion will be well-nigh unbearable in a few months if permission to build the express track all the way down Third Avenue is not given. They point out that a new subway cannot be built and put into operation in less than four years, and that traffic to the Harlem River and across is increasing rapidly all the time.

A MUNICIPAL OWNERSHIP EXPERT'S EXPERIMENT IN CHICAGO

Dr. M. F. Doty, one of Mayor Dunne's "traction experts," tried an experiment on the Wabash Avenue line in Chicago last week, which resulted in much delay to passengers, and would have ended seriously had not President Mitten of the company countermanded the orders given by the doctor. Dr. Doty's idea was to increase the capacity of the Wabash Avenue loop, upon which cars are now being operated under a headway of 28 seconds. His plan was to have the trainmen close the gates on the right-hand side of the cars between Randolph and Madison Streets and close them on both sides between Adams and Jackson Boulevard, allowing no person to get aboard in this block.

As during the rush hours there is not more than 30 seconds' headway on this loop and it takes at least a minute to change the gates, and under Dr. Doty's plan this had to be done twice in two blocks, the cars naturally became blockaded. As a result, he had cars piled up all around the loop. President Mitten, of the Chicago City road, came over to see how the experiment was progressing, and had to take the management of the road out of Dr. Doty's hands to get the cars running. A second attempt by Dr. Doty the following day resulted in the loop becoming blockaded again, and traffic was restored only by the interference of President Mitten.

MUNICIPAL OWNERSHIP ORDINANCE PASSED BY THE CHICAGO CITY COUNCIL—STREET RAILWAY AFFAIRS IN GENERAL

The traction situation in Chicago took a sudden turn on Jan. 18, when the City Council, meeting in a committee of the whole, passed Mayor Dunne's $75,000,000 Mueller certificate ordinance. The traction franchise ordinances, upon which so much time has been spent, were not voted upon.

At the opening of the meeting a motion was made to substitute the minority report of the transportation committee for that of the majority report, thereby substituting the Mueller ordinance for the extension franchise ordinances. Alderman Cullerton, a former supporter of the franchise ordinances, seconded the motion. After several hours of argument the Mueller ordinance was passed. The passage was effected only by the votes of about fifteen Aldermen, who heretofore have opposed the Mayor and the municipal ownership ordinances.

The more important sections of the ordinance passed read:

Be it ordained by the City Council of the city of Chicago:

Section 1. That for the purpose of acquiring street railways either by purchase, construction, condemnation, or otherwise as provided by law, and for the equipment of such street railways in and upon the streets of the city of Chicago hereinafter described, so as to provide for a first-class street railway system, the city of Chicago may issue and dispose of its interest bearing "street railway certificates" in the manner provided by law, not to exceed the sum of $75,000,000.

Sec. 2. That said street railway certificates or the proceeds arising from the issuance and sale thereof shall be used by the city of Chicago for the purpose of acquiring either by purchase, construction, condemnation, or otherwise, street railways, together with the equipment thereof, in and upon and along the streets upon which street railway tracks are already located.

The second portion of the ordinance, providing for the municipal operation of the street railway systems, is:

Be it ordained by the City Council of the city of Chicago:

Section 1. That the question of the operation of street railways by the city of Chicago as provided in the aforesaid act be submitted to popular vote at the next election, to be held in the city of Chicago on the third day of April, 1906.

Sec. 2. The question to be voted on at said election shall be, "Shall the city of Chicago proceed to operate street railways?"

Sec. 3. This ordinance shall be in force from and after its passage.

Alderman Cullerton, who seconded the motion to adopt the minority report of the committee and thereby throw the franchise ordinances out of consideration, said:

It is useless to pass the majority report and submit it to the people for approval when we have been informed that the Chicago City Railway Company will not accept it. The traction question has been in politics as a municipal issue for eight years. While Mr. Harrison was Mayor he declared the traction question would not be settled until it was settled right. But Mr. Harrison never confided to any one what he believed to be the right way to settle it. The traction question carries with it the lowering of the tunnels. Real estate values in the southwest section of the city have decreased 100 per cent in the last few years because of the failure of the city to lower the tunnels. The commerce which made Chicago what it is to-day is being rapidly driven to the Calumet River and South Chicago.

The Chicago Union Traction Company is bankrupt, and the Chicago City Railway, which is solvent, refuses to accept what the committee has offered. Even if the city wins the ninety-nine-year litigation in the Federal Supreme Court, it will bring no real relief. The owners of these traction bonds are attempting to use this City Council to sell their bonds. I am opposed to the passage of the majority report.

The street railway companies were not represented at the meeting. President Mitten, of the Chicago City Railway, refused to discuss the action of the Council, but it is said he and others believe that should the ordinance be passed at the spring election, a test case would raise not only the general question of whether the Mueller law certificates are legal, but the point raised by the opponents of the ordinance, that it is contradictory to the intent of the Mueller law, as the ordinance does not provide for applying the certificates to the purchase or construction of a single system of street railways in one transaction.

James H. Eckels, one of the receivers of the Union Traction Company, said in regard to the action of the Council:

There is no possibility, in my opinion, that the end aimed at in the Council action will ever be realized. The final test will come on the validity of the Mueller certificates, and the Mueller certificates will never stand the test of the courts. I doubt that a majority of the citizens of this community would vote for an appropriation of the magnitude which will be required to purchase the properties.

At a meeting of the City Council Monday night, Jan. 22, no attempts were made to amend the Mueller ordinance. The minutes of the meeting at which the measure was passed were approved unanimously. After the meeting Mayor Dunne stated that he had until next meeting to make any amendments.

At the meeting of the Chicago City Council, Monday, Jan. 22, an ordinance was passed commanding the commissioner of public works to remove at once all the turnstiles in the elevated stations on the Union loop.

A severe sleetstorm Sunday night resulted in almost a complete tie-up of several of the elevated roads. Traffic was not restored to normal condition until late Monday morning. The surface lines also experienced difficulty in operating cars, but the service on these was not so much affected as was that of the elevated lines.

Suit has been brought by the city against the railway companies, charging them with having disobeyed the public comfort ordinances of the city in respect to heating cars, furnishing seats and providing frequent cars. One suit is brought against the Chicago Union Traction Company for $1,500,000, and another for $500,000 against the Chicago City Railway Company.

Regarding the bringing of the suits, Julius G. Grossberg, special legal adviser for the administration, said:

"The suits are ordinary actions in debt, and the cause of action is the claim that both companies have disobeyed the 'public comfort' ordinances and rendered themselves liable to the amount of fines claimed in the suits.

"It is a new form of action, and I do not know that it will hold, but the idea is to stop a multiplicity of suits by consolidating all the cases brought before the justices which may be brought into one. It will also forestall a suit for injunction to stop our suits in the justice courts."

"It has been held," said Col. E. R. Bliss, for the Chicago City road, "that a suit in debt can be brought to collect a fine under a penal ordinance, so I guess Mr. Grossberg is all right on that proposition. I am afraid, however, he will find he must set up in his pleading specific instances of violation, and the common counts will not do. As for stopping an injunction suit, that cannot be done if there is any cause for bringing one."

MR. VREELAND ON WELFARE WORK

The National Civic Federation, of New York, has just issued in pamphlet form the address on "Welfare Work," delivered two or three months ago before the New England Cotton Association at Atlantic City, N. J., by Herbert H. Vreeland, president of the New York City Railway Company. Mr. Vreeland is chairman of the welfare department of the National Civic Federation, and has given a great deal of attention to this subject. In this address he described the welfare work among some of the progressive mills in New England, Vandergrift, Pa., Dayton, Chicago, and elsewhere, many of which are conducted by special superintendents called welfare managers, superintendents, or secretaries. He also described in detail some of the work of the Metropolitan Street Railway Employees' Association in New York, including the library, relief association and recreation rooms. He emphasized the importance of the employer or president taking an active interest in any work of this kind which may be started, and stated that there is a tendency in the average foreman to oppose any such plan until thoroughly acquainted with the result.

As to the attitude of the employees toward welfare work, he said: "It may be stated generally that employees will welcome all efforts properly introduced to provide for their physical, mental and moral welfare. An employer who is noted among his employees for fair dealing need have no fear in introducing welfare work after a careful study of conditions has been made. That is to say, after recognizing the first needs of employees to be steady work, an equitable wage, and hours as short as competitive conditions will permit, the employer may successfully install welfare work, if proper attention is given to its introduction."

In conclusion, he said: "The motive of the employer is one which comes before us constantly. While the economic value of welfare work must be admitted, it is pleasant to find that the average employer promotes welfare work from the humanitarian standpoint. It is not difficult to prove that it is desirable from a mercenary point of view. One may enumerate such advantages as the attracting of skilled employees who will seek work where the conditions are best; good discipline and self-respect, which may be secured through opportunities for cleanliness; a permanent set of employees, as against a constantly changing force which requires effort to train, and necessitates the loss of much material wasted; and a happy, contented class of workers."

BOSTON TRANSIT COMMISSION ISSUES SPECIAL REPORT

Acting by the authority of the Massachusetts Legislature of 1905, the Boston Transit Commission issued a report on Jan. 20, presenting the results of an exhaustive study of the transportation problem in Boston. The Commission summarized its conclusions as follows:

1. The subways already authorized will provide sufficiently for the future so far as concerns the traffic to the south.

2. The subways already authorized will provide for a considerable increase in the traffic capacity toward the north. The capacity of the bridges across the Charles River will limit the traffic in this direction.

3. In order that all tracks may be used to their full capacity, the East Boston Tunnel tracks should not be permanently connected at grade with the present subway tracks at Scollay Square, thereby diminishing by one-half the capacity of its own tracks and that of the through tracks in the present subway north of that point; but eventually these East Boston Tunnel tracks should either end in a loop under Scollay Square station or be extended to the west as a part of some east and west through line.

4. The act providing for the East Side subway (for surface cars east of the Washington Street Tunnel) should be amended so as to allow that subway to be built at a greater distance from Washington Street, so that it may pass over, rather than under, the East Boston Tunnel.

5. The Cambridge Street subway should not be connected at grade with the Tremont Street subway, but should either end in a loop or form part of some through line to the east. If ending in a loop, further study may indicate that it is desirable to carry this subway toward the neighborhood of Park Street.

6. Additional provision should be made without delay for the traffic toward the west. The Commission recommends that the present subway under Boylston Street and the Public Garden be extended immediately to Copley Square, or to some other point or points farther west, as further study may determine, separating the grades of the Boylston Street and Huntington Avenue tracks. A new line should also be constructed from a point near the junction of Commonwealth Avenue and Beacon Street to a new station at Park Street.

7. In laying out any comprehensive subway or elevated transportation scheme, grade crossings should be avoided as far as possible. Every such crossing reduces the traffic capacity of the tracks involved. The construction of a subway or an elevated road is so expensive that the capacity should be kept if possible at a maximum. Stub ends should be avoided if practicable, and loops should be provided, which do not reduce the capacity of the tracks.

8. The danger to surface structures now erected or to be erected is not such as to be a barrier to the further construction of subways. It is not probable that in the future greater difficulties will have to be surmounted than have already been overcome in the construction of the East Boston and Washington Street Tunnels.

The Commission estimates that in 1915 the Boston Elevated Railway Company will carry 394,000,000 revenue passengers, and in 1925, 628,000,000. It appears probable that in the next ten years the street-car traffic in Boston will increase normally some 60 per cent, and will double in from fifteen to twenty years. Additional facilities are needed for the traffic already existing. The Commission states that while the transportation facilities have been doubled within the past ten years, yet the cars are now uncomfortably crowded in the rush hours and not infrequently in the middle of the day. The Commission proposes that the cars now running on Washington Street be diverted into the Tremont Street subway when the Washington Street Tunnel begins operation. The Washington Street Tunnel will not be completed in less than a year and a half. The Commission believes that the business district will be well provided for with the Atlantic Avenue elevated, the Tremont Street subway, the Washington Street Tunnel and the East Side subway in operation. South Boston and Dorchester can be cared for if necessary by an extension of the Atlantic Avenue elevated. The report states that the present congestion on Boylston Street and on Massachusetts Avenue cannot be avoided while the trackage is limited as at present. On Boylston Street from the entrance of the subway to Berkeley Street there are now scheduled in the maximum hour 220 cars. The Commission suggests that the reasonable capacity of a surface track should be about 160 cars per hour. By utilizing both the surface trackage on Boylston Street and by extending the subway, the Commission believes that 400 cars per hour could be handled on and under Boylston Street.

Several routes are suggested for the Back Bay subway work; the Commonwealth Avenue line, the new Charles River embankment route, and a subway loop from Columbus or Huntington Avenue to the South Station, and a Park Street-South Station subway under Winter and Summer Streets. A loop is planned beneath the surface at the North Station for cars using the present subway. This would enable the easy extension of the subway northward in the future and would give a higher traffic capacity than a surface loop hampered by grade crossings.

DATES SET FOR SALE OF APPLEYARD PROPERTIES

The decrees have been entered in the United States Court for the sale of the Dayton, Springfield & Urbana Electric Railway; the Urbana, Bellefontaine & Northern Railway, and the Columbus, London & Springfield Railway, respectively, at Springfield, Bellefontaine and Harmony, on Feb. 16, and of the Central Market Street Railway and the Columbus, Grove City & Southwestern Railway in Columbus on Feb. 17. These several properties will probably be turned over to the new owners about March 1. The upset prices are fixed as follows:

For the Dayton, Springfield & Urbana, $300,000, subject to bonds of $750,000; for the Urbana, Bellefontaine & Northern, $175,000; for the Columbus, London & Springfield, $250,000, subject to bonds of $1,500,000; for the Central Market, $150,000, subject to bonds of $500,000; for the Columbus, Grove City & Southwestern, $35,000, subject to bonds of $208,000. No competition is expected generally, except in the case of the Dayton, Springfield & Urbana. The chief bidder, if not the only one, it is thought, will be A. E. Locke, of Adams & Company, Boston, chairman of the reorganization committees, who holds practically all of the floating indebtedness, having purchased it from the creditors of the roads.

The liabilities of the various companies over and above the bonded indebtedness are substantially as follows, namely: For the Columbus, London & Springfield, $1,100,000, including 208 Columbus, Grove City & Southwestern bonds guaranteed, but not including 500 Central Market bonds guaranteed; for the Dayton, Springfield & Urbana, $1,300,000, including 500 Urbana, Bellefontaine & Northern bonds guaranteed, and 155 Springfield & Western bonds guaranteed, but not including 600 Kenton & Southern bonds; for the Urbana, Bellefontaine & Northern, $35,000 of notes issued are included in the Dayton, Springfield & Urbana liability; for the Columbus, Grove City & Southwestern, $117,000, and for the Central Market, $362,000. These liabilities in each case are exclusive of the bonded indebtedness, except that of leased companies as hereinbefore described.

CHANGES IN CLEVELAND COMPANY

At the annual meeting of the Cleveland Electric Railway, held last week, several important changes were made in the personnel of the company. J. J. Stanley, general manager, was given the additional office of vice-president and will be the active head of the company, as it has been announced that President Horace Andrews will in the future spend the greater portion of his time in New York, managing the affairs of the New York Central traction properties. C. F. Emery was made second vice-president. All other officers and directors were re-elected, except that W. D. Rees was elected a director in place of the late L. W. Prior. George Radcliffe, heretofore division superintendent, was made general superintendent, and A. E. Doty, another division superintendent, was made assistant general superintendent.

THE MILAN CONVENTION OF THE INTERNATIONAL STREET & INTERURBAN RAILWAY ASSOCIATION

The committees to report on two more questions to be considered by the International Street & Interurban Railway Association (Union Internationale de Tramways et de Chemins de Fer d'Intérêt Local) at its Milan convention next September, have been announced by the secretary. They are as follows:

Ninth Question.—Track construction for urban tramways. Committee: Messrs. Dubs, manager of the Marseilles Tramways, and Busse, chief engineer of the Grosse Berliner Tramways.

Eleventh Question.—The use of wattmeters on city cars. Committee: Mr. Wattman, manager of the municipal tramway system in Cologne.

A complete list of the topics to be considered was published on page 837 of the Street Railway Journal for Nov. 4, 1905.

LINE PROJECTED BETWEEN DENVER AND LEADVILLE

An electric railway is projected between Denver and Leadville, a distance, by the route proposed, of 115 miles. H. T. Herr, formerly with the Denver & Rio Grande Railroad Company, who is interested in the new project, says there is a distinct field for the new line in the territory it is proposed to traverse, more especially as the distances between the terminal cities by steam railroad are 151 miles for the Colorado & Southern, 209 for the Colorado Midland and 275 for the Denver & Rio Grande. There is a part of the old Denver & Rio Grande survey that is to be used, and it is also said that a portion of Platte canon will be utilized. Lines will radiate from Leadville to various mines and the tunnel through the range will open the Alma and Fairplay districts and many low-grade mines so that ore shipments can be made much lower than the present compared $4 a ton rate. From Leadville the lines will extend to the Horseshoe district and Twin Lakes. Mr. Herr is now negotiating with the Westinghouse Company, of which his brother, E. M. Herr, is first vice-president, for the equipment of the line with the single-phase system.

THE PENINSULAR RAILWAY

The Peninsular Railroad Company, which has filed articles of incorporation at San Jose, Cal., with a capital stock of $5,000,000, and $205,000 subscribed, purposes to build 204 miles of electric railway. O. A. Hale, president of the San Jose & Los Gatos Interurban, is president and chief stockholder and manager of the company, and F. E. Chapin, of the Interurban Company, is treasurer. Lines are to be built from San Francisco to San Jose through Stanford University, Palo Alto, Redwood City and San Mateo. Branch lines will extend to Los Gatos, Sempervirens Park, Alviso, Oakland, Aalameda, Alum Rock Park and the Lick Observatory on Mt. Hamilton. It is said that the new road is backed by the Southern Pacific, and that the first lines constructed will be from San Jose to San Francisco and to Oakland, one on each side of the bay. The report is that the main coast line of the Southern Pacific will be shortened by a cut-off from Mountain View, and that the trains for Los Angeles and points beyond will go via Santa Cruz, while San Jose will be served by the new electric lines of the Peninsular Company, which will enter San Francisco through the Mission, using the tracks that are to be abandoned by the steam cars as soon as the Bay Shore cut-off is completed on the line to San Jose. One of the reasons given for the early construction of the new system is the completion of the Hanchett-Martin companies in and around San Jose. It is reported that the United Railroads, which has an electric line from San Francisco to San Mateo, had a compact with the Southern Pacific not to build south to San Jose if the Southern Pacific would not build another line north from San Jose to San Francisco. O. A. Hale recently said: "We intend to sell not only transportation, but power for irrigation and for illumination."

PENNSYLVANIA'S PROPOSED WORK IN NEW YORK

The Pennsylvania Railroad, through President Cassatt, has made public its plans for developing its facilities in and about New York. It intends to spend at least $100,000,000. The plans are set forth in detail in a letter President Cassatt has written to Mayor McClellan, and to President Orr, of the Rapid Transit Commission, of New York. Mr. Cassatt appeals strongly against overtaxation, especially against payment for the right to carry freight to and from the city, which charges were suggested at a recent hearing of the Commission by the engineer in charge of the Bureau of Franchises. The proposed charges are: $250,000 gross on signing the franchise, $50,000 a year for ten years, and $100,000 a year for the next fifteen years, the rates to be subject to indefinite readjustment at the end of twenty-five years.

The company, Mr. Cassatt says, intends to build a huge freight terminal, to be called Sunnyside Yard, between Jackson and Thompson Avenues, in Queens Borough. It will be a mile long, nearly one-third of a mile wide, and will include an area of about 8712 city lots, or abou 400 acres.

The elimination of grade crossings on the railroads of the Long Island Company is the second of the company's plans. Next come local delivery yards for freight in Brooklyn and Queens. The sites and areas of the proposed new yards are as follows:

Freight terminal at Bay Ridge, between Sixty-Fourth and Sixty-Sixth streets, extending from Fourth Avenue to the bay, 790 city lots.

Delivery yard at Fifth Avenue and Sixty-Fifth Street, Bay Ridge, 35 city lots.

Delivery yard at Fifteenth Avenue and Sixtieth Street, Bath Junction, 44 city lots.

Delivery yard on Gravesend Avenue (Parkville), 98 city lots.

Delivery yard at Manhattan Beach Junction, East Sixteenth Street and Avenue I, 150 city lots.

Delivery yard, Vanderveer Park, Flatbush Avenue, 90 city lots.

Delivery yard at Paerdegat Basin, near Canarsie, 95 city lots. This is convenient to the contemplated municipal improvement of Jamaica Bay, set forth in the late communication by Comptroller Grout to the Commissioners of the Sinking Fund.

Delivery yard at Rockaway Avenue, 80 city lots.

Freight terminal at East New York, 566 city lots.

Delivery yard at Bushwick Junction, 96 city lots.

The construction of a new freight terminal at Third Street and Hunter's Point Avenue, and of a freight delivery yard north of Hunter's Point Avenue, to occupy an area of 109 city lots.

The connecting railroad, which is to be 12 miles long, will cross the East River by a bridge at Ward's and Randall's Islands. This railroad will be connected with the tunnel line by a short, direct line, giving Manhattan, as well as Queens and Brooklyn direct communication with the north.

The execution of these works, says President Cassatt, depends largely on the fairness with which New York will treat these interests.

The right to cross streets is asked, Mr. Cassatt says, only where the company shall own both sides of the street.

ANNUAL REPORT OF AMERICAN LIGHT & TRACTION

The American Light & Traction Company's annual report for the year ending Dec. 31, 1905, shows net increased earnings over the previous year of $203,657, or 17.98 per cent. The company's earnings for the last two years compare as follows:

Year—	1905	1904
Earnings on stock of subsidized companies owned by this company	$1,222,785	$1,007,001
Miscellaneous earnings, interest, etc.	150,835	144,502
Gross earnings	$1,373,620	$1,151,503
Expenses	37,452	18,993
Net earnings	$1,336,168	$1,132,510
Dividends	747,328	669,132
Surplus	$588,840	$463,378

The company's condensed balance sheet as of Dec. 31, 1905, compares with the previous year as follows:

Assets—	1905	1904
Investment account	$24,103,177	$23,472,283
Treasury stock (102,469 shares common stock)	1	1
Furniture and fixtures	1,299	1,039
Undivided profits subsidized companies	1,468,156	1,260,759
Bills receivable subsidized companies	1,625,904	1,024,887
Accounts receivable	24,413	51,898
Stocks held for temporary investment	2,976	95,885
Cash on hand and in bank	409,738	209,211
Total	$27,635,664	$26,115,964
Liabilities—		
Preferred stock	$9,633,200	$9,396,900
Common stock	15,000,000	15,000,000
Bills payable	500,000	2,147
Reconstruction reserve	179,205	....
Dividends accrued and payable Feb. 1, 1906	192,029	....
Undivided earnings	2,131,230	1,716,916
Total	$27,635,664	$26,115,964

During 1905 the dividends paid on the preferred stock was at the regular rate of 6 per cent per annum. Beginning with Aug. 1, 1905, the dividend on the common stock was increased from the rate of 3 per cent annually to 4 per cent annually.

During the year the company added to its list of properties those of the Quebec-Jacques Cartier Electric Company, of Quebec, Canada; the Muskegon Traction & Lighting Company, of Muskegon, Mich., and the Lacombe Electric Company, of Denver, Col.

The item of $500,000 in the bills payable balance sheet of 1905 represents money borrowed when the Muskegon property was acquired. This will be paid off from funds to be received from the sale of the recently authorized issue of stock, the subscriptions to which are payable Feb. 5.

RAILWAY LEGISLATION IN IOWA

Governor Cummins, of Iowa, in his message to the Thirty-First General Assembly, made certain recommendations affecting the steam and interurban railways which are quite likely to be acted upon. Of these recommendations the one of primary import to the electric railway interests has to do with the passage of an act which would allow one railroad company to make the same rate between competitive points within the State as does any other railroad. Under what is known as the "long and short haul" clause in the statutes of Iowa, a railway company cannot charge a smaller fare for a long distance than it does for a short distance. The Governor says, "The general justice of such a provision is unquestionable, but I believe that there are circumstances under which the railways should be permitted to meet competition without effecting intermediate points. You will better understand what I mean through an illustration. A passenger desiring to travel from Des Moines to Marshalltown has the option of several routes. The Chicago & Great Western line is the shortest route, and the fare which the company is permitted to charge is three cents per mile. I can see no good reason why the Chicago & Northwestern, for instance, should not be permitted to carry the passenger for the same fare that is allowed to the Chicago & Great Western line, without affecting the charge to intermediate points between Des Moines and Marshalltown on the Chicago & Northwestern line. I therefore recommend such an amendment to the law as will authorize the Board of Railroad Commisioners, under such circumstances, and after due investigation, to relieve the railways from the effect of the long and short haul clause in the statute. I do this not only because I believe it is just to the railways, but because it will greatly convenience the traveling public."

The passage of such a law will probably bring on a competitive rate war in Iowa between the interurban and the steam railroads. Under the provisions of such an act the steam roads could put interurban service on their lines which touch competitive points along the interurban lines, just as the Rock Island did last year between Iowa City and Cedar Rapids, and make the same rate or a lower rate than the interurbans maintain between the said points. The Rock Island was compelled to abolish the interurban service maintained between those points above mentioned on account of the long and short haul provision of the statutes, under which it could not charge a less rate between Iowa City and Cedar Rapids than between Iowa City and Ely, a point on the line between Iowa City and Cedar Rapids.

LOUISVILLE & NORTHERN RAILWAY & LIGHTING COMPANY

To secure the payment of $2,500,000 5 per cent bonds when they become due in December, 1925, a mortgage from the Louisville & Northern Railway & Lighting Company to the American Trust & Savings Bank, of Chicago, and Frank H. Jones, trustee, has been filed in the office of George W. Stoner, Recorder of Clark County, Ind., at Jeffersonville. The instrument is signed by Samuel Insull, president, and J. O. English, secretary. It is set forth in writing that the action was authorized at a meeting of the directors and stockholders held on Dec. 28, 1905.

It is stipulated that $500,000 of the amount is to be used at once for building electric lines in the counties of Clark, Floyd, Harrison, Washington, Orange, Jefferson, Scott, Jennings, Crawford, Perry, Spencer, Farrick, Vanderburg and Jackson. According to this the eastern terminus would be at Madison, and the western at Evansville, the southern being Jeffersonville, and the northern at Seymour, a line from the former place to Indianapolis having been in operation for some time.

A second road, seeking a northern outlet, the Louisville & Indianapolis Traction Company, has already been surveyed to Seymour, 49 miles north of Jeffersonville, and considerable of the right of way has been secured. A road from Jeffersonville to Sellersburg, which is to pass through Watson, 6 miles north of Jeffersonville, is now being graded by the Louisville & Southern Indiana Traction Company, there being a likelihood this may go on to Charlestown, 7 miles north of Watson, but the inducements so far offered have not been sufficient to cause the promoters of the road to give out officially that the road would go to Charlestown.

It is thought that Louisville is to be the junction point for a line from Evansville to Cincinnati in one direction, and from Louisville to Chicago in the other. Extensive preparations that have already been made in and around Jeffersonville show there is something more than a road from New Albany to Louisville to be built and that at once. As rapidly as possible the road now operating under the name of the Louisville & Southern Indiana Traction Company is being double-tracked and the rails are down from Court Avenue and Spring Street, in Jeffersonville, to the western limits of Howard Park. There is another good stretch of double track west of the Baltimore & Ohio Southwestern Railroad, which leaves a short piece of single track to Glenwood Park, from which place on down to the end of the line in New Albany there is a double track.

ACCIDENT ON BROOKLYN ELEVATED

One man was killed and thirteen persons were injured in an accident on the Lexington Avenue elevated line of the Brooklyn Rapid Transit Company, at Fulton and Chestnut Streets, Brooklyn, shortly after noon Friday, Jan. 19. One car of a three-car train bound for Cypress Hills, left the tracks, plunged over the guard rail and shot into the street, about 20 ft. from the structure. At Fulton Street, near Chestnut Street, there is an incline about a block long, running from the elevated structure to the surface tracks of the Long Island Railroad Company, which is used in summer for operating the elevated trains from Broadway Ferry to Rockaway Beach. As it was the company's plan to run a test car over the tracks on Friday, an employee was ordered to remove the switch pins at the point where the incline begins. About the time the test car was due, a three-car train en route to Cypress Hills came along at a moderate rate of speed. The first car passed safely over the switch, but the second car took the switch. The coupling between the first and the second car broke and the front wheels of the second car swerved over the westbound tracks, carried away the guard rail and plunged over the incline. The coupling between the second and third cars broke and the last car swung diagonally across the tracks, being kept on the structure by the other guard rail. In the third car there were about a dozen passengers.

AN EFFORT TO SECURE FREIGHT RIGHTS IN PENNSYLVANIA

An organized effort is to be made to have the next Pennsylvania Legislature pass a bill to give the electric railway companies the right to carry freight. Farmers and shippers throughout the entire State are in accord with the plan that has been evolved, and organizations are now being perfected to lend aid to the movement. The Chester County Agricultural Association is one of the bodies foremost in the agitation, and the Grangers throughout the State, at their recent meeting in Sunbury, adopted resolutions favorable to it. J. J. Sullivan, president of the American Railways Company, is reported to be foremost among railway men in urging the need of legislation. It is said that in an effort to check the movement for the support of the bill among Chester County farmers, the Pennsylvania Railroad Company has offered to give the West Chester Street Railway Company a right of way through property owned by the railroad between Gallagherville and Coatesville. This is after opposing the electric railway company for more than two years. The committee appointed at the recent convention of West Chester farmers has sent to Governor Pennypacker a copy of the resolutions which were adopted.

Several delegations from various sections representing the electric railway interests called upon the Governor last week and solicited his favorable action in the matter. In response to a telegraphic call from Philadelphia, a conference of electric railway officials was held at the Commonwealth Hotel, Harrisburg, on Monday, Jan. 22, to consider the matter. If the call is issued such a bill will be promptly introduced and is certain to be supported almost unanimously by the representatives from districts outside of the cities of Philadelphia and Pittsburg. Representative Creasy, of Columbia, has been fighting for years for the passage of such a bill, and proposes to offer a resolution at this special session authorizing the Governor to amend his call so as to include this subject.

PROPOSED LINE FROM LANSING TO GRAND LEDGE

A. A. Piatt, president of the Piatt Light & Heat Company, of Lansing, Mich., is authority for the statement that a company will be organized to build an electric railway from Lansing to Grand Ledge, with probable extensions connecting it with Ionia and Charlotte. The Piatt Company will build a concrete dam at Grand Ledge this spring, and in connection with the flowage rights has secured a large part of the right of way for the proposed road, and it seems very probable that the line will be built during the coming season.

NEW PUBLICATIONS

Report of the Third Annual Meeting of the American Railway Mechanical and Electrical Association, held at Philadelphia, Sept. 25-26, 1905. Published by the Association; 295 pages.

This report is the first to appear of those conventions held at Philadelphia last fall, and will be read with interest, not only by those who were not present at the meetings, but by those who were. The Philadelphia convention of this association was particularly valuable this year and the discussions and papers will well bear rereading. The report includes a portrait of President Baker and a statement that the association will hereafter be known as the American Street & Interurban Railway Engineering Association. The front cover shows a representation of the official badge used as Philadelphia.

Earth and Rock Excavation. By Charles Prelini. New York: D. Van Nostrand & Company; 357 pages; illustrated. Price $3.

The chief objects of this book, as described by the author in his preface, are "first, to concentrate in a small volume descriptions of the different operations which are required for planning and executing any work of excavation in either earth or rock; and, second, to classify and describe clearly the various implements and machines used for excavating and hauling away the material." With these objects in view, the author first presents a discussion of the methods of calculating earthwork. Succeeding chapters consider the various methods of planning and executing works of excavation, and describe methods for deducing the cost of such work in any particular case. Finally, a chapter is devoted to brief descriptions of a number of large works of excavation. The book is illustrated by diagrams and views of earthwork appliances.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED JAN. 16, 1906

809,956. Amusement Device; Charles H. Jaeger, New York, N. Y. App. filed Oct. 10, 1905. An amusement device consisting of a stationary body representing a vehicle in which the occupants may be seated to face either forward or rearward, and connections for imparting rocking movements to the stationary body.

809,999. Railway Signaling; Samuel D. Strohm, Philadelphia, Pa. App. filed Aug. 29, 1891. Mechanism arranged to automatically set danger signals and to apply the air brakes on a following train in case it passes a danger signal.

810,027. Electric Signal; Charles C. Blake, Brookline, Mass. App. filed Aug. 19, 1905. A selective signal system consisting of a transmitting station having a series of pendulums adapted to send electric impulses of different periodicity over a line wire when connected thereto, a series of way stations, each provided with a pendulum device adapted to respond to the vibrating of one only of said transmitting pendulums, an electric lamp signal and a semaphore arm which becomes operative when the unison of vibrations is established between the transmitter and receiver.

810,069. Overhead Trolley Harp and Shoe for Electric Railways; John Miller, Jr., Amesbury, Mass. App. filed March 17, 1905. A pivoted shoe mounted in the trolley harp in place of the usual wheel, has anti-friction rollers at each end thereof. Means for lubricating the shoe.

810,240. Electric Motor Controller Regulator; Paul A. Weyland, Maywood, Ill. App. filed June 14, 1905. An attachment for ordinary car controllers, having a plate movable with the controller arm upon which is a freely pivoted lever. The lever co-operates with stationary cam grooves and ratchet teeth in such a way that the controller arm must be moved step by step to its "on" position, but can be swung to its "off" position from any one notch without resistance.

810,316. Emergency Rail Brake; Powell O. Adams, Cameron, Tex. App. filed July 6, 1903. Consists of a plurality of levers arranged in pairs and each pair having a transverse swinging movement and adapted to grasp a rail and pneumatic-pressure-regulated pistons connected to said levers, each lever being provided with a bearing roller.

810,323. Switch-Operating Device; William A. Chun, Houston, Tex. App. filed July 18, 1905. Details of construction.

810,326. Car Fender; Joseph B. Connor, Liverpool, England. App. filed Sept. 19, 1905. A vertically suspended gate having such connection with a scoop mounted in the rear thereof that when the gate encounters an obstruction it will swing backward and throw the scoop to operating position.

PERSONAL MENTION

MR. E. G. McGAW has resigned from the Portland Railway Company, of Portland, Ore., to enter other business. Mr. McGaw was for fifteen years superintendent of the east side lines of the City & Suburban Railway Company, of Portland.

PROF. ALBERT S. RICHEY, head of the department of electric railroading at Worcester Polytechnic Institute and formerly connected with the Indiana Union Traction Company, of Indianapolis, is bereaved by the sudden death of his wife at Worcester, Jan. 15. Mrs. Richey was the only daughter of Mr. John Neely, of Muncie, Ind., at whose home the funeral was held.

MR. E. A. TURPIN, chief clerk to General Manager A. L. Drum, of the Chicago & Milwaukee Electric Railroad, has been appointed purchasing agent of the company. Previous to his connection with the Chicago & Milwaukee Electric Railroad, Mr. Turpin was acting superintendent of freight and express traffic of the Indiana Union Traction Company and chief clerk to the general manager.

MR. WARREN BICKNELL has retired as president of the Lake Shore Electric Railway to become president of the Cleveland Construction Company, with offices in Cleveland, succeeding Mr. Will Christy. The company makes a business of building and financing properties, and it is now identified with several important projects. Last week Mr. Bicknell was surprised at his home by motormen and conductors of the Lake Shore Electric Railway, who presented him with a magnificent grandfather's clock. Mr. Bicknell's efforts in building up the Lake Shore Electric have met with remarkable success. A year ago the property showed a deficit of $18,000, while the past year there was a surplus of $115,000. The percentage of cost of operation to gross receipts was reduced from 65.73 in 1904 to 54.37 in 1905.

MR. WARREN P. BRISTOL, general manager of the Meriden Electric Railway, of Meriden, Conn., has been appointed acting general manager of the Hartford lines of the Consolidated Railway Company, to succeed Mr. Frank Caum, who has accepted the position of general manager of the Scranton Railway. Mr. Bristol has been manager of the Meriden line since November, 1895, when he succeeded Mr. W. C. Gray. He was born in Cheshire, April 18, 1873, and went to Meriden Oct. 13, 1893, with the engineering corps under Mr. Norman McD. Crawford, formerly manager of the Hartford Street Railway Company, when the corps was laying out the line between Meriden and Wallingford. When the line was completed Mr. Bristol remained in Meriden as assistant to Superintendent Gray and became his successor when the road was bought by the New York, New Haven & Hartford Railroad Company.

MR. JAMES C. ERNST, president of the Cincinnati, Newport & Covington Railway, was pleasantly surprised at his office in Covington, Ky., a few days ago, by the receipt of a letter of thanks, in folder form, for the recent gifts of cash to the employees of the company. The frontispiece of the folder contains a likeness of Mr. Ernst surrounded by four views of the power station. Inside is the letter of thanks, to which are attached the signatures of the employees. The letter read: "Mr. James C. Ernst and Board of Directors. Gentlemen—We the undersigned employees of the power station wish heartily to thank you for your Christmas remembrance. We appreciate the fact that in extending this gift to us you were moved alike by a desire to raise the morale of the force and to show your personal interest in each of us. We can only thank you and endeavor by faithful and diligent service to merit your confidence." Mr. Ernst will have the letter framed and hung in his private office.

MR. FRANK CAUM, who, since Mr. Norman McD. Crawford retired as general manager, has been the acting general manager of the Hartford lines of the Consolidated Railway Company, operating the electric railway properties owned by the New York, New Haven & Hartford Railroad, has resigned to become the general manager of the Scranton (Pa.) Street Railway Company. Mr. Caum came to Hartford Aug. 1, 1894, as engineer at the power station and was made superintendent of the Hartford Street Railway Company in October, 1897. He succeeded Mr. Crawford in June last year. Mr. Caum formerly lived in Meriden, and in 1889 went to Rochester, N. Y., where he was engineer of the power station of the street railway system. From there he went to Jersey City, N. J., as chief engineer of the power station of the Consolidated Traction Company. He left that post to come to Hartford. While in Rochester he was associated with Mr. Crawford, who was general manager of the system. He was also associated with Mr. Crawford in New Jersey.

Street Railway Journal

Vol. XXVII. NEW YORK, SATURDAY, FEBRUARY 3, 1906. No. 5.

Published Every Saturday by the

McGraw Publishing Company

Main Office:
NEW YORK, Engineering Building, 114 Liberty Street.
Branch Offices:
Chicago: Monadnock Block.
Philadelphia: Real Estate Trust Building.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York"; "Stryjourn, London"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada, Mexico and the Canal Zone.

Street Railway Journal (52 issues)..............................$3.00 per annum
Single copies ....10 cents
Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August and November) $4.00 per annum
Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy)............................$6.50 per annum

To All Countries Other Than Those Mentioned Above:
Street Railway Journal (52 issues), postage prepaid...................... $6.00
25 shillings. 25 marks. 31 francs.
Single copies..20 cents
Remittances for foreign subscriptions may be made through our European office.

NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the Street Railway Journal.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires.

NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal 8500 *copies are printed. Total circulation for* 1906 *to date,* 41,000 *copies, an average of* 8200 *copies per week.*

The Central Electric Railway Association

The amalgamation of the Ohio and Indiana interurban railway associations, at Dayton, Jan. 25, into the Central Electric Railway Association, is an important event in the history of the electric railway industry. Both Ohio and Indiana have played important parts in the development of this class of road, and nowhere else in the world than in these States is interurban railway practice exemplified on a larger scale. The former State has now more miles of electric railway track than any other in the Union, although it is exceeded in population by both New York and Pennsylvania, while Indiana surpasses all States in length of individual lines. After the financial success of interurban railways had been demonstrated in Ohio a few years ago, and before their construction had been taken up to any considerable extent in any other State, it was gravely maintained by a number of students of electric railway economics that the large traffic on the Ohio interurban roads was due to some esoteric reasons which led the people of Ohio to travel frequently from town to town, but that the same results could not be expected after crossing the State line. Mr. Henry, of the Indiana Union Traction Company, and the other pioneers and builders of interurban electric railways in the neighborhood of Indianapolis, proved the falsity of this conclusion, and demonstrated that if the proper service is given, the traffic will follow.

The possibilities of the new association in the way of increasing our knowledge of electric railway practice are immense. In spite of the advance which has been made in interurban electric railroading during the last few years, there are many unsolved problems, and the vigor with which both associations have been conducted in the past is ample warrant for believing that with united energies results will be secured which will be of great benefit to the entire industry. So far both associations have confined themselves, very wisely we believe, to operating questions. There is so much to be done in this line, and the managers themselves are the only ones to do it, that the operating department seems a more fruitful field for study and discussion than construction methods. We wish the association all prosperity in the future.

San Francisco's Street Traffic Problems

The report of Wm. Barclay Parsons on the best solution for the transportation problem in San Francisco, published in our issue of Jan. 6, continues to excite considerable discussion in that city. A number of the members of the Merchants' Association, to whom the report from Mr. Parsons was rendered, are not satisfied with his recommendations, and at a recent meeting made a protest against any expert advice which did not agree with their preconceived opinions. The fact that underground conduit lines were in operation in New York City and Washington seemed to them to be ample proof that the system was most desirable for adoption in the downtown streets of San Francisco. The prime object of any street railway system, viz., that of transporting passengers, was lost sight of by the advocates of the conduit, as it usually is in discussions of this kind. The claim that the trolley system was a disfigurement to the streets, and that it was dangerous to persons and property, formed the main objections to its admission into the center of the city.

This same question has arisen from time to time in deciding upon the equipment of the transportation systems of other large cities, and San Francisco is practically the last in this country which has to face the problem. Those who have the best interests of the city at heart look upon this attempt to compel the adoption of the conduit system as unfortunate. It is true that New York and Washington have street railways of this character and that their cars are in successful operation, but the local conditions are entirely different. In New York, for instance, the cars do not attempt to run out into the suburbs, and the system on Manhattan Island is so large that the important question of uniformity of equipment has no bearing upon the situation. Washington, also, is a city almost destitute of suburbs, and the problem of through cars and of changes from overhead to conduit is practically eliminated. Again, there is woeful lack of appreciation of the cost of maintenance and renewals on the part of those who advocate the conduit construction. The investment cost of conduit construction is by no means the only one which enters into the difference in expense. The maintenance of the conductors in the conduit may be comparable with that of the overhead system, but the cost of renewals of special work, yokes and conduit, and these all have a definite life, will greatly exceed that pertaining to the trolley system, while the cost of plows is very much greater than that of the collectors on the overhead system. There are other factors which have contributed greatly to the success of the lines in New York and Washington, and which might not and probably would not obtain in any other city. For instance, the drainage is good, the pavements are maintained in excellent condition and the streets are kept very clean by the municipal authorities in both places. But in a city like San Francisco the argument for uniformity of equipment is an overwhelming one, and even if we disregard the item of expense, that point alone should decide the question of the proper system to employ.

More About Trailers

As we have several times noted, there is a strong tendency toward resuming the use of trailers. In general principles it is advantageous, since it enables the car capacity to be doubled while requiring the service of but a single extra man, and the pair of cars practically requires very little more room on the street than a single car. To revert to our principle of the dangerous space carried ahead of every car, the space required for a car upon the street is its own length, plus its dangerous space at the given speed. Owing to the extra braking facilities on a car and trailer, the dangerous space is about the same as for the single car, while the mere length of the trailer represents nearly the whole of the added space required. Therefore, a crowd can be handled more advantageously as well as more cheaply when trailers are used. The single question that is uppermost in the discussion of trailers is that of danger. The judgment of many street railway men in recent years is that the danger to passengers is increased by the presence of the trailer. To this proposition we are rather inclined to dissent, provided the trailer is what a trailer ought to be and not merely a motorless car that is towed. The line of success in trailer design is, in our opinion, in the direction of a construction akin to vestibuled cars, using a specialized trailer for that purpose only. The real danger point is the gap between the motor car and the trailer. Once close up that effectively and the use of the trailer is entirely safe. We have not yet seen, however, any effective way of doing this while using an ordinary car in the role of a trailer.

The modifications necessary for safety go considerably further than merely connecting the cars together, but when the design of trailers as such is deliberately taken up we shall be much surprised if a successful trailer system is not devised. In this particular we should call attention that the legitimate function of a trailer is to increase the capacity of the car unit and not to take the place of a car. If there is one principle more than another that has made for the success of American street railways it is that cars on short headway gather traffic far better than trains on long headway. A car and trailer is no substitute for two cars as a traffic winner, but it helps amazingly during hours of heavy load. Particularly on long lines it comes into play effectively during the rush hours. Do not use it for decreasing the number of car units if you expect it to win friends. It is like the case sometimes found in which a given bit of line may have twelve cars an hour, but unhappily timed so that the actual service is four groups of these cars each on a 15-minute schedule. And then the general manager wonders why the kicks come in. Properly designed and used in their legitimate sphere, the trailer should fill a very useful place in the general economy of a street railway system. One advantage it has that should not be lightly passed over—the reduction of the trippers necessary during the rush hours and during special emergencies. So long as people persist in keeping approximately the same range of working hours, just so long the street railway man will have to figure despairingly on how to handle half a city in two or three hours. The use of trailers is no panacea for such ills, but it may serve as an anodyne. At least it is worth looking into very carefully before it is relegated permanently to oblivion. It served a good purpose once and it may again.

Car Design and Traffic

It is interesting to consider the relation between car design and traffic in the light of the present tendency of some of the later electric roads to purchase expensively finished rolling stock. In some cases cars have been specified for moderate speed suburban or rural service, costing from $9,000 to $10,000 each, a large part of the expense being due to the quality of the interior and exterior finish. A high-speed car for heavy interurban service may easily cost $10,000 if it is built for very fast running, but as a general rule, rolling stock units designed for speeds of 35 m.p.h. or 40 m.p.h. maximum do not reach the foregoing figures of first cost. In some quarters the idea prevails that the purchase of such expensive cars is a hazardous policy for any road which has not been operated long enough to prove its financial soundness, while in other circles the advertising value of such superb cars is considered ample justification for their being supplied.

Looking at the matter broadly, there is no doubt that the public is constantly demanding more improved accommodations upon both steam and electric railways as the schedule speeds increase and cars become heavier. Within the last five years car builders have produced rolling stock units for trolley service which exceed in comfort and appearance many of the cars used on long established steam railroads, and with each new design the tendency is strong to improve upon previous productions. The requirements of different roads vary widely; practice in the direction of reducing fire hazards and withstanding the shocks due to high-speed operation has been influential in preventing the thorough standardization of cars, and the public taste for luxurious equipment has grown by leaps and bounds. There is no doubt that, other things being equal, preference is invariably given to the handsomest cars by the traveling public, and there is no question that the advertising value of a superbly finished, vestibuled, double-trucked piece of rolling stock, with a roomy aisle, large plate-glass observation type windows, comfortable seats and brilliant, diffused interior lighting is exceedingly large.

On the other hand, it would be of doubtful wisdom to equip a large system with a complete outfit of $10,000 rolling stock units unless the financial strength of the enterprise at the start is sufficient to assume such a heavy burden of fixed charges, with the absolute certainty that the road will pay, and pay well. The smaller the road, the fewer are the cars which it requires, so that it would seem better practice to concentrate extra costly finish upon the very small number of cars representing the road than to carry out the idea in the multiplied expense of the larger system. In the latter case, two or three of the more costly cars can frequently be run as limiteds to advantage, leaving the balance of the equipment to be represented by more sober designs. In any case, comfortable riding is of great importance, and liberal dimensions in aisles, seats and vestibules are certain to be appreciated by the discriminating passenger. As for the small road, one would not invariably recommend the purchase of the most costly cars that the manufacturers can produce, by any means, but in general, the motto that what is worth doing at all is worth doing well is applicable. Doubtless local conditions will often be met by a car of moderate cost, but it is certainly a mark of hasty judgment to condemn as extravagant the purchase of the best type of car when the reasons for its selection bid fair to lead to the creation of a desirable volume of traffic. When a road is ultimately to form a link in a through route in competition with a steam line, the importance of attractive rolling stock is not to be gainsaid in its probable influence upon the business to be handled.

A Little More Speed

As last year, the Florida automobile races have given one something to think seriously about. We are used to having records raised quite in the ordinary course of racing events, but to have them projected upward in the fashion of last week is somewhat startling. It makes one stop and consider the probable result had the machines been running on a nice, smooth bit of straight track, well ballasted and laid with 100-lb. rails. As it was, the winner of the fastest mile managed to negotiate the distance at the rate of a little above 128 m.p.h. This performance was, of course, an egregious sprint, with all the steam that could be piled on carried for the necessary half-minute, irrespective of all other consideration. The same machine was signally defeated in a 5-mile run by the gasoline machines, and kept discreetly out of the longer events. But for the sprint it did the trick, and can probably fairly enough be called the fastest thing on wheels. The chances are that during the mile it topped even the tremendous maximum speed reached in the Zossen trials. Even more startling from a practical standpoint was the performance of the big gasoline car that won the 100-mile race at a maintained speed only a shade under 80 m.p.h. This is, we believe, by all odds the fastest run ever made by anything over a similar distance. The nearest approach to it in railway work was a run of 44 miles by the Black Diamond Express nearly nine years ago, at 80 m.p.h. The only higher speed has been made at relatively short distances.

It would be exceedingly interesting to know what actual power was developed in this tremendous performance. The car was rated at 80 hp, and there is no way of getting behind the returns to see what interpretation is put upon this statement. As a rule, gasoline engines are not underrated, especially on stock cars, and the losses in transmission are somewhat heavy. But this was a racer, and there was some glory to be had in adhering to an ultra-conservative rating. However, whatever the horse-power, the results were sufficiently remarkable. At such speed the air resistance was a predominant factor in the work done. Even so, there must have been still a considerable "track" resistance even on the hard-packed sand of the beach, and one turns again to speculate on what the great racer would have done on a good track. We do not altogether approve of some features of the automobile situation, yet, as we have over and over suggested, the value of the automobile in engineering development has been great, and will be greater. It has stimulated the improvement of the internal combustion engine as nothing else could, and the result is being felt not only in self-propelled vehicles, but in central station design. There has been of late a movement toward gasoline and gasoline-electric cars, not only for street work, but for railway service. The experience gained in automobiles will be valuable in traffic vehicles on rails. No mere road can give as favorable traction conditions as a well laid pair of rails, and if a thoroughly practical gasoline railway car appears it will have a very considerable use on lines with relatively light traffic and with moderate grades. The weak point of all internal combustion engines is a certain inflexibility of output that makes them inconvenient for rapid acceleration and for work where there is much stopping and starting. The gasoline-electric combination is a partial but complicated remedy for this difficulty. But even with these limitations there may be found use for the gasoline car presently, since the long roads with light traffic are the very ones in which high acceleration is needless.

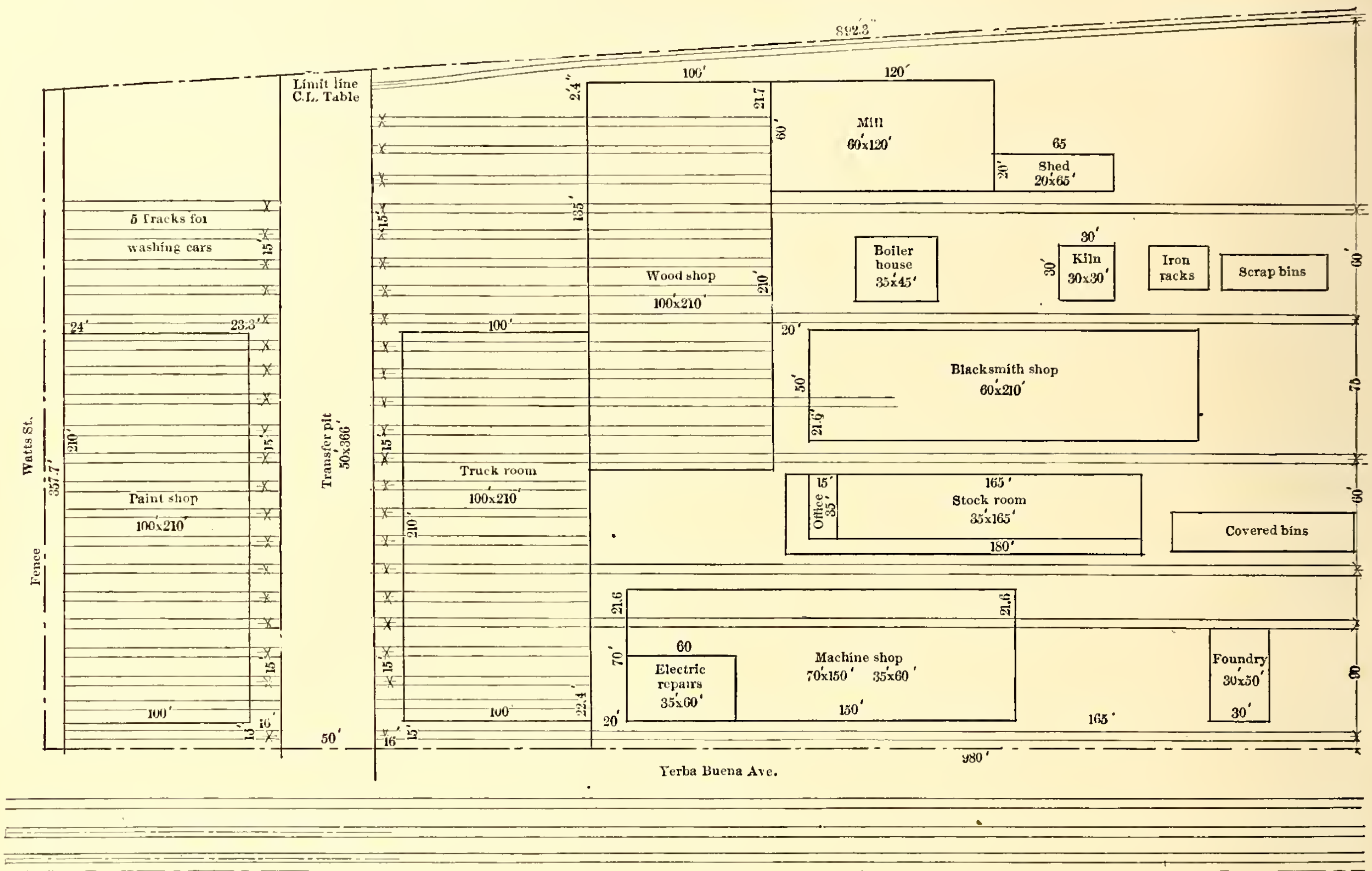
The cost of repairs and renewals in automobiles are, of course, high—so high as at present to constitute a serious failing from a purely commercial standpoint. No machine, however, gets harder usage than an automobile upon ordinary roads, and what is done under these conditions is no fair criterion of what might be done in gasoline motor cars designed for steady work on smooth track. It would be very desirable to have an engine able to work on heavier hydrocarbons than gasoline, owing to the relatively small output of the latter in the petroleum industry. As improvements in carburetting devices are made, this situation will certainly be improved. Another weak point is in the power transmitting devices, and here there is room for the exercise of independent ingenuity. In ordinary automobile practice the transmission is a more difficult problem than it would be on an automobile car, but the conditions of operation are also different, so that the solution advisable in the one case might not be in the other, particularly in view of the difference of speeds of engine. In educating the public to a faster pace the automobile is certainly doing a thorough, if sometimes thankless, job. Certainly any speed that is permissible in a vehicle that uses the highway should be allowed in vehicles that keep to their own appointed track on the same highway. In the automobile business as such there is little of menace to street railways, for the mere question of cost is likely permanently to keep down the number of people who use their machines to avoid riding in the cars. It is only where a fit of overenthusiasm leads to legislation unduly favoring public automobiles on the road as against cars on a track that danger is to be feared. Meanwhile the new developments are not useless, in that they give at least the chance for a new and convenient motive power for cars, not to be used probably as a substitute, but as a complement to those now existing. And races like those just closed, unpractical as they seem at first sight, have a value in technical and popular education. We shall hope to see the records sent upward again next year.

NEW SHOPS OF THE OAKLAND TRACTION CONSOLIDATED AND KEY ROUTE SYSTEMS

The Oakland Traction Consolidated and the San Francisco, Oakland & San Jose Railway, both of Oakland, Cal., are allied companies, with practically identical ownership and management. The former operates 218 miles of city and interurban lines in and between Oakland, Berkeley and Alameda, and connects those cities with San Leandro, Fruitvale and Haywards. Its old shops were located at Elmhurst on the Hayward line, at Temescal on the Berkeley lines, and at Piedmont for the Oakland system.

About two years ago the San Francisco, Oakland & San Jose Railway inaugurated a ferry and electric train service between San Francisco and Oakland, Berkeley and Piedmont, now popularly called the "Key Route" system (see the STREET RAILWAY JOURNAL for Jan. 2 and 9, 1904), and the necessity soon became apparent that new shops should be secured in a location which would be central to both systems, and in which all the repair and construction work for both companies could be carried on.

The new power house of the Key Route had been located on Yerba Buena Avenue, on the main Key Route line and within a few yards of the shore of San Francisco Bay. Property adjoining the power house site was then secured for the new shops. The site has a frontage of 980 ft. on Yerba Buena Avenue, as shown on the accompanying plan. The Key Route main line passes on Yerba Buena Avenue, with a station at Hollis Street and another at San Pablo Avenue, one block east. Oakland Traction surface lines on San Pablo Avenue and Hollis Street have direct connection with the shop trackage and connect with all the other lines of the Traction system. About one-third of the property lies in Oakland and two-thirds in Emeryville, the shops deriving their name from the latter.



PLAN OF NEW OAKLAND TRACTION SHOPS

GENERAL VIEW, OAKLAND TRACTION SHOPS

In addition to the connection with the electric railway lines, the shops have direct rail connection with the Southern Pacific and Santa Fe Railroads, and, by means of the 3-mile pier and dock terminal of the Key Route in San Francisco Bay, have deep-water facilities for receiving river, coast and ocean shipments.

Although but four blocks from the bay, the shop site has an elevation ranging from over 24 ft. to 14.75 ft., giving a slope of about 1 ft. in 100 ft., and thus providing good drainage.

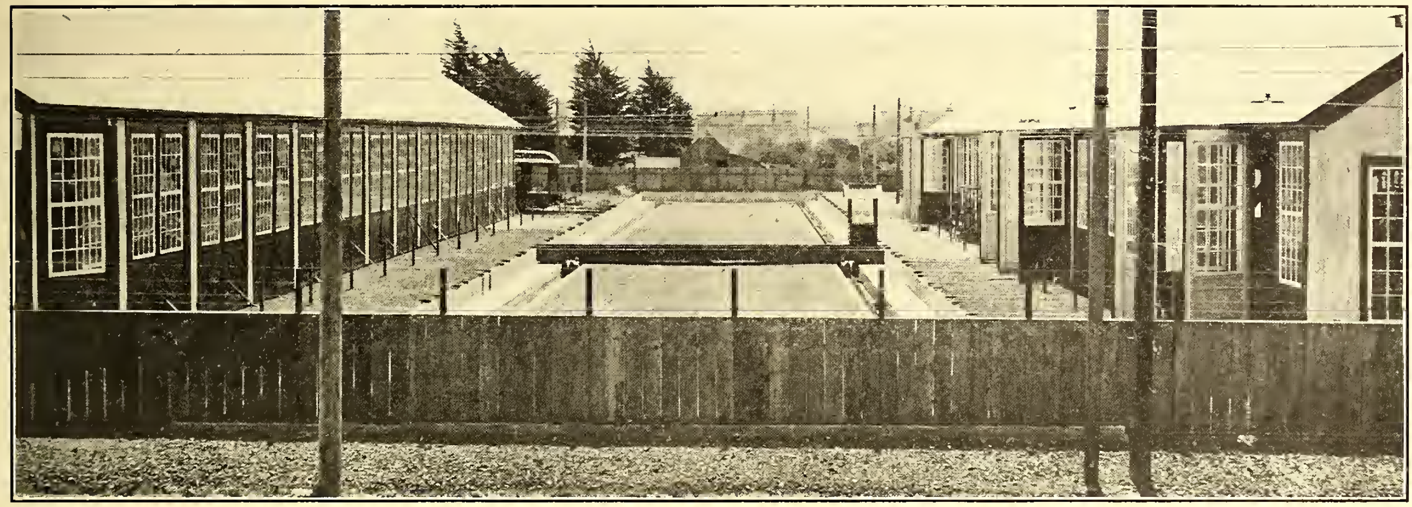
ARRANGEMENT OF BUILDINGS

The shops and grounds have been laid out so as to provide for the greatest amount of work with the least handling of material and expenditure of time, as well as to provide for future extensions of the buildings when their capacities are reached. With this idea in view, the shops were laid out as indicated in the plan. One through track enters from the west, and three other through tracks are laid so they can be extended through to Hollis Street or connected with the one that at present extends outside. A track on the north side connects with the Key Route and Oakland Traction lines on Yerba Buena Avenue.

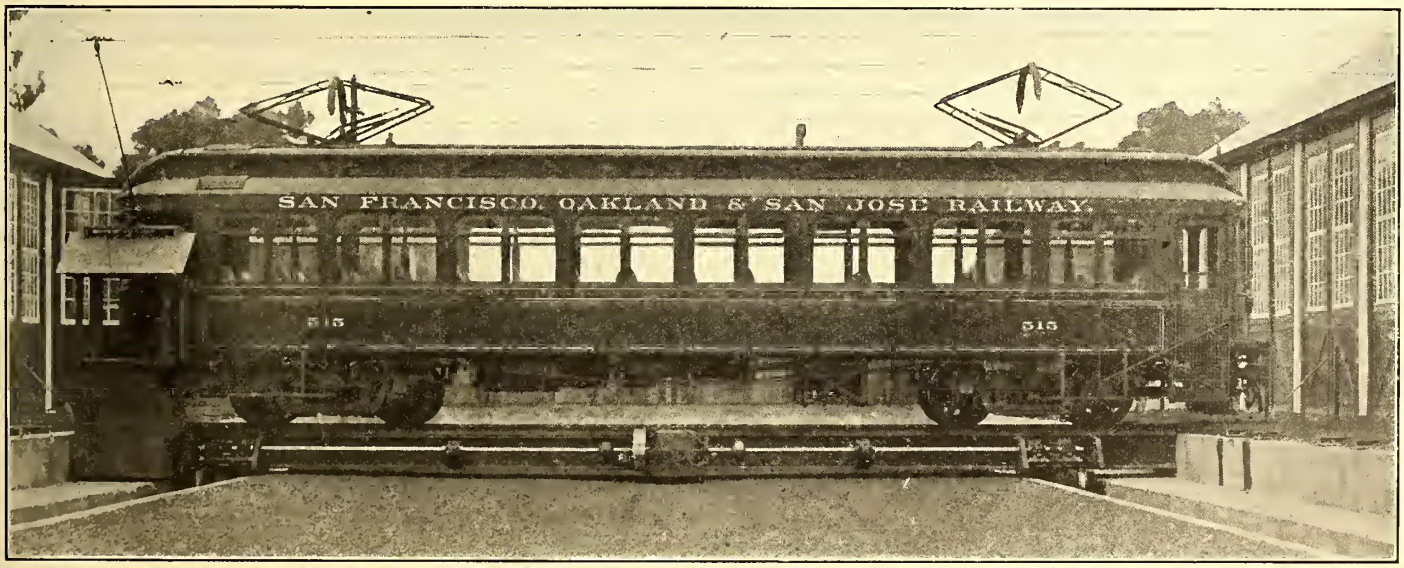
The paint shop is located on the east side of the transfer pit, with the truck room, wood shop and planing mill on the west. Beyond to the west at convenient locations are the forge shop, storeroom, machine shop and foundry. A total of twenty-four tracks are laid across the yards, connecting the buildings, as shown on the plan. The through tracks are laid with 70-lb. A. S. C. E. standard section T-rails, and the other shop tracks with 40-lb. T-rails.

The buildings are all of substantial construction and rest on heavy concrete footings. They were designed for light, strength and convenience, and while their cost of erection was considerably less than would be necessary for structures serving the same purpose in Eastern States, they are entirely serviceable and of sufficient strength and permanency to minimize depreciation.

Heavy mill construction has been adopted throughout, the framing and roof trusses consisting of heavy timbers. Galvanized corrugated sheet iron was used for sheathing and roofs, nothing else being necessary, as the mild climate of the San Francisco Bay region makes thicker or more heat-resistant material unnecessary. A total of 13,955 sheets, or 108,180 linear ft., of sheet iron and 942,000 ft. of lumber was used in the construction of the buildings. As will be noticed from the illustrations, the buildings are very well lighted, most of them having skylights, in addition to side and door windows. A total of 24,581 sq. ft. of glass was used.



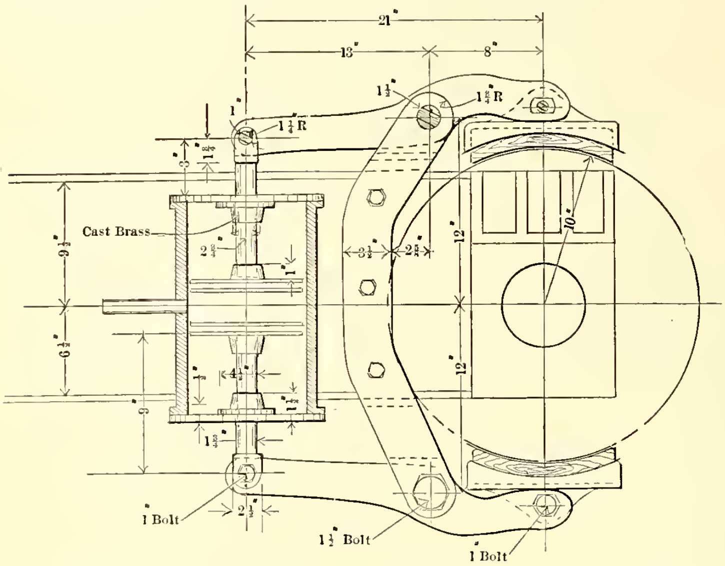
TRANSFER PIT, WITH PAINT SHOP ON LEFT AND TRUCK SHOP ON RIGHT, OAKLAND TRACTION COMPANY



TRANSFER TABLE WITH CAR, OAKLAND TRACTION SHOPS

TRANSFER TABLE

The transfer table runs in a pit 366 ft. long between the paint shop on the east and the truck room and carpenter shop on the west, thus serving all of the twenty-four parallel tracks. The table was designed by the Oakland Traction engineers and was built in the company's shops. It is of simple construction, but embodies many original ideas in its details. The table is 50 ft. long, the distance between rails of pit being 40 ft. It is designed for a safe load of 80 tons, and will carry a heavily loaded freight car with a deflection of but 3-16 in. at the center. It will handle any of the Key Route cars, the longest of



DETAILS OF BRAKE FOR TRANSFER TABLE, OAKLAND TRACTION SHOPS

which are nearly 60 ft. over all. The two main girders of the table are each built up of two 18-in., 55-lb. I-beams and two 16-in. x ¾-in. steel plates. The truck girders are 10 ft. 10 ins. long, and each is formed of two 12-in. x ½-in. steel plates. The table is cross braced at the center, the braces being extended on one side to form a support for the driving motor. The weight of the entire table is 15.5 tons. Each truck is supported on two 22-in. diameter steel-tired double-flanged wheels mounted with a 10-ft. wheel base.

The table is driven by a GE 800 motor, supported at the center of the table and geared by pinion and gear to a 3-in. cold-rolled steel shaft. At each end the shaft is connected by double pinion and gear to one of the two truck wheels. The table has a speed of 4 m.p.h.

An air brake has been designed for the table which has, for each truck, a double air cylinder 8 ins. in diameter and 15 ins. long, as shown in the sectional diagram on this page. The two pistons operate levers directly connected to shoe brakes, which work on a 20-in. brake wheel. This wheel is mounted on the shaft of one of the truck wheels. The shoes are of oak, made so that they may be easily replaced. Air is supplied from a storage tank on the table that is charged from the air-piping system of the shops. The motor for driving the table and the air-brake system are controlled from a small cab on the west end of the table, power being taken from an overhead trolley running along that side of the pit. Separate trolley wires are carried across the pit for each shop track, so that in running straight across, the trolley arm does not have to be lowered.

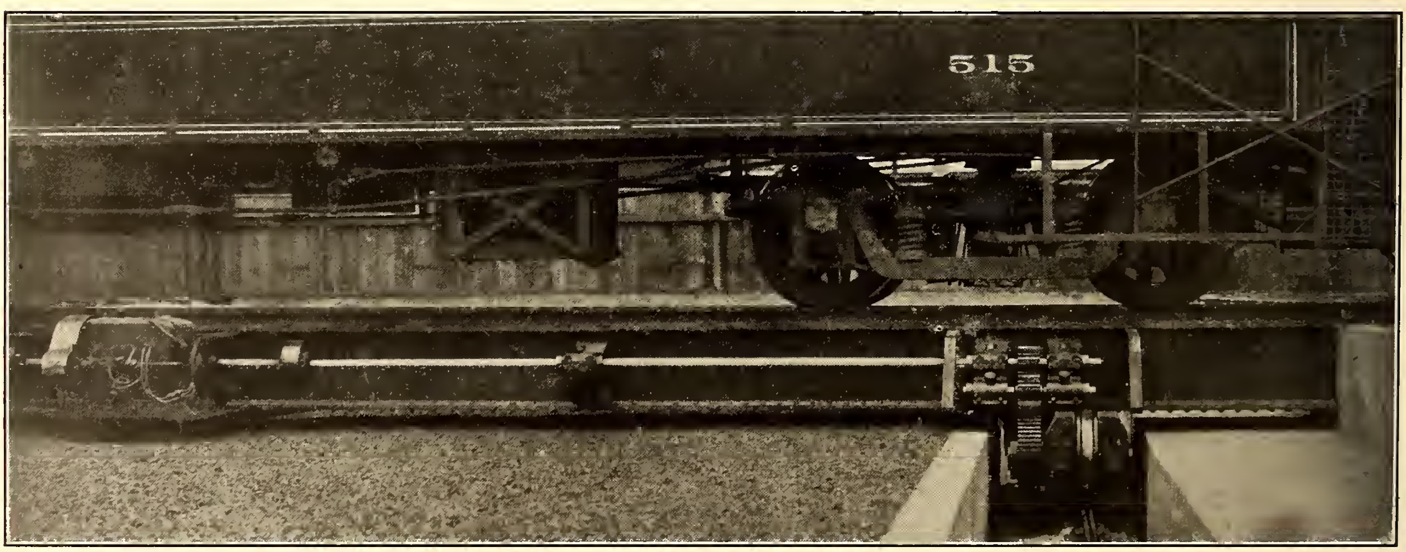
The pit surface is of crushed rock, which is oiled to bind it into a tight surface and to keep out the weeds and water. Ample drainage is provided by connection to the sewer. The track consists of 70-lb. A. S. C. E. standard section T-rails, set in concrete. The track pits are 4 ft. below the surface, and the central part of the main pit 2 ft. below the surface level.

PAINT SHOP

The paint shop, running along the extreme east end of the property, is 210 ft. long x 100 ft. wide. The roof is formed of two bents supported longitudinally through the center by wooden posts. The building is very well lighted, as may be noticed from the illustrations. A total of 4032 sq. ft. of window glass and 1685 sq. ft. of skylights was used.

In the southeast corner of the shop is located the paint stock room, where the paints, oils and supplies for immediate use are kept in drawers, bins and shelves. Along one end are individual lockers for the workmen to store their brushes, tools and personal supplies. A zinc-lined bin is provided for storing waste; a grinder is located on one side of the room, and in the center is a zinc-covered platform for mixing purposes. Adjoining the storeroom are washing trays and a lye vat. Individual clothes lockers are provided in this as well as the other shops for the workmen. They were made in the shops and are ventilated by wire netting.

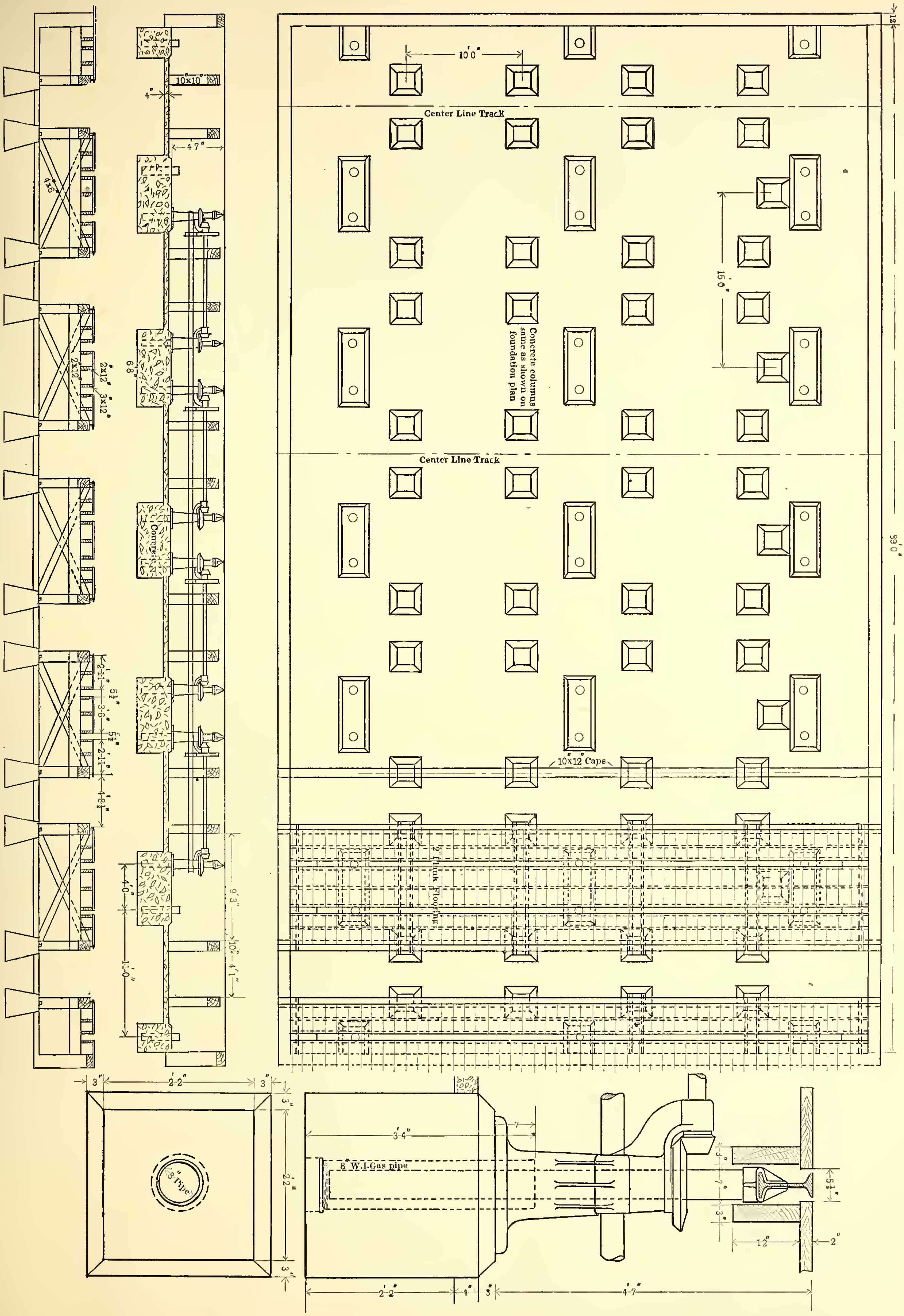
Fourteen tracks enter the building, each being long enough to hold a Key Route car and one of the Oakland Traction cars. At the south end of the paint shop is ample space for extending the building when future requirements demand the room. At present a space 70 ft. x 115 ft. immediately adjoining the building is to be used for car-washing purposes. Four tracks cross this space, which is well ballasted with broken rock and drained to the sewer.



DETAIL OF TRANSFER TABLE, SHOWING MOTOR DRIVE AND GEAR CONNECTION TO DRIVING WHEEL, OAKLAND TRACTION SHOPS

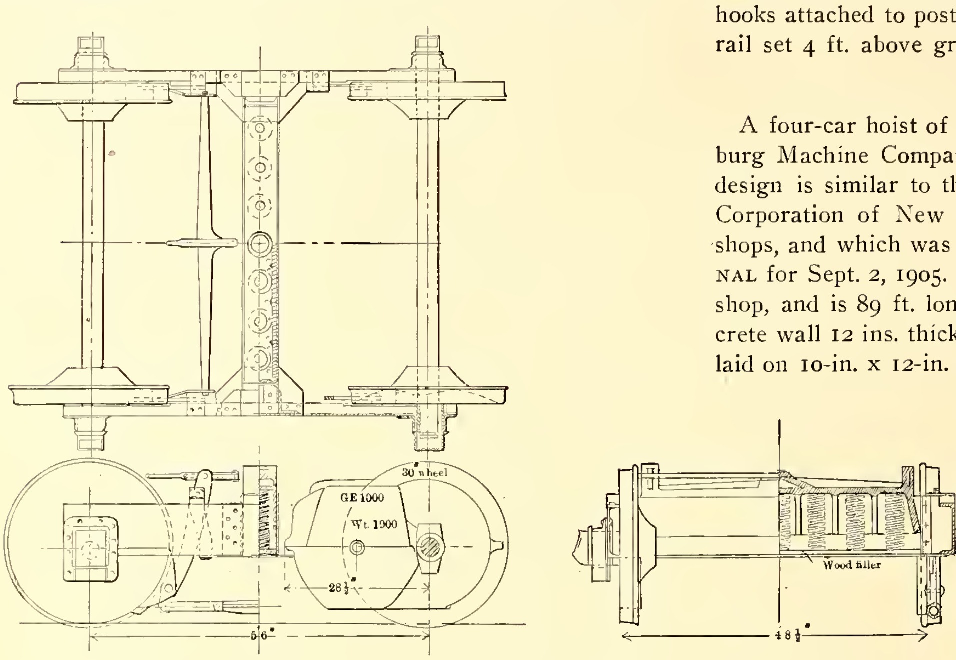
TRUCK ROOM

On the west side of the transfer pit and 14 ft. from it is the truck room, a building with two bays, 100 ft. x 210 ft. Fourteen tracks extend across the shop, five of which continue into

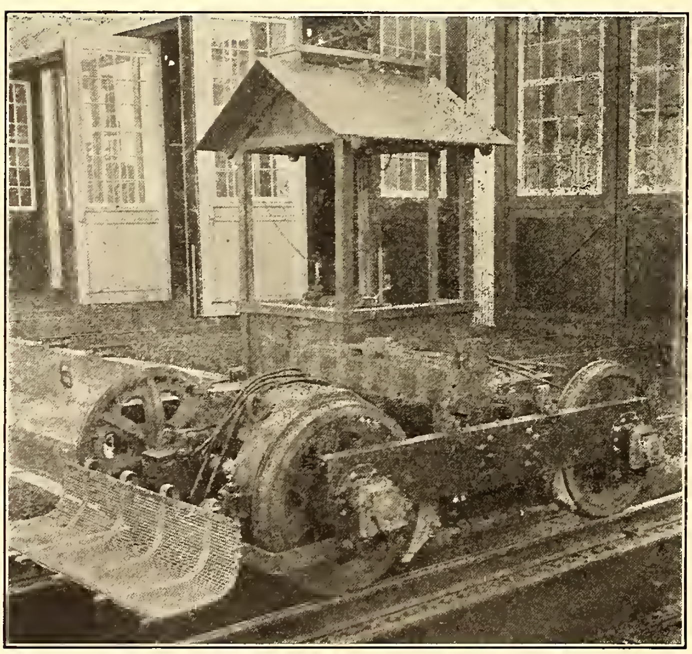


DETAILS OF PITS AND CAR HOISTS IN TRUCK SHOP, OAKLAND TRACTION SHOPS the wood shop, as shown on the plan. The truck room is well lighted by side windows containing 3600 sq. ft. of glass and by 1685 sq. ft. of skylights.

On the center posts of the shop are mounted six jib cranes with pneumatic hoists. These cranes were designed by the company's engineering department. Five of them have a capacity of 3000 lbs. and a radius of swing of 12 ft., and one has a capacity of 4300 lbs. and a radius of 10 ft. In order to afford proper support for the cranes, the center posts of the west bay of the truck room were put in as single pieces, 8 ins. x 8 ins., 36 ft. long, and carried through to the rafters. The post is reinforced and is double cross braced. The headroom in the shop is 17 ft. 4 ins. The rafters have wrought-iron caps for tie-rods, and the bents are cross braced with tie-rods centering in bull-rings.



DETAILS OF MOTOR TRUCK, CLASS I, OAKLAND TRACTION LINES


CLASS I TRUCK, USED ON OAKLAND TRACTION CONSOLIDATED LINES

The doors of the truck room and paint shop opening onto the transfer pit are double, each single door being 6 ft. wide and 16 ft. 8 ins. high. Each has a double sash of twenty-four panes of 12-in. x 17-in., 16-oz. glass, thus affording very good light when closed. The doors are hung on three sets of wrought-iron hinges. The door hinge piece is a 2½-in. x ⅜-in. strap, 5 ft. 3¼ ins. long, with eyes fitting over ¾-in. pins on the stationary piece. The latter is 3 ft. 3½ ins. long, and has pins at both ends for adjoining doors. Each door is held open by hooks attached to posts, the latter consisting of pieces of 40-lb. rail set 4 ft. above ground and neatly aligned.

CAR HOIST

A four-car hoist of the new type manufactured by the Pittsburg Machine Company is installed in the truck room. The design is similar to that of the one which the Public Service Corporation of New Jersey has installed in its Plank Road shops, and which was described in the STREET RAILWAY JOURNAL for Sept. 2, 1905. The pit is located in the east bay of the shop, and is 89 ft. long inside and 50 ft. wide. It has a concrete wall 12 ins. thick and is 4 ft. 7 ins. deep. The tracks are laid on 10-in. x 12-in. caps, which rest on 10-in. x 10-in. posts, that in turn are supported on concrete footings. The caps are cross braced between tracks by 4-in. x 6-in. pieces. A plank flooring is laid between the tracks on 12-in. stringers, which in turn rest on 12-in. cross beams. This construction leaves the space between the rails of each of the six tracks crossing the pit open and free for the workmen.

The hoist, as shown in the drawings, is formed of two 9-in. I-beams, 45 ft. long, for each track. Each beam carries one side of the car, and is supported on three 7-in. steel jack screws that are raised and lowered through cast-steel bevel gears and pinions. The pinions on opposite jacks are mounted on 10-ft. shafts extending across the pit, three for each hoist. These short shafts are in turn driven through straight gearing from a motor-driven line shaft running the length of the pit. Each jack screw operates in a case consisting of an 8-in. wrought-iron gas pipe, 3 ft. 4 ins. long, set 2 ft. 6 ins. in the concrete footing. The case is filled with lubricating oil. Automatic limit switches are provided to stop the hoist at its maximum height above the floor. The hoist I-beams extend the width of


PLANING MILL, OAKLAND TRACTION SHOPS

the pit, and when not in use rest in 5½-in. slots, flush with the floor. Each hoist is arranged with a clutch so it can be thrown in or out of gear. This hoist is capable of raising the heaviest Key Route cars, and does the work quickly and efficiently.

CLASS I TRUCK

The type of truck that has been adopted for the cars of the Oakland Traction Consolidated has several interesting features.

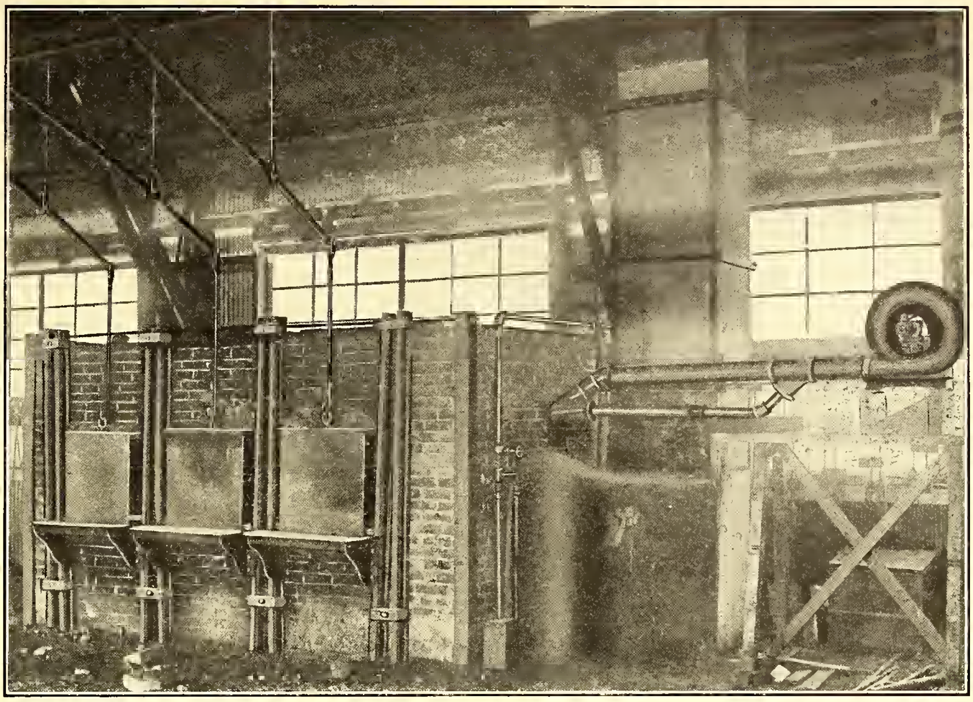
It is known as the Class I truck by reason of its general resemblance to that letter, and was designed a few years ago by J. Q. Brown, assistant general manager and engineer of the company. Although not fully meeting with the favor of the officers of the road at first, it has proved by its merits to be the type of truck best suited for the conditions of the local cars, and is now fast superseding all other forms of trucks. In fact, no trucks have been purchased since the company began to build the Class I truck. About 200 are now in use, and they are being installed under other cars as fast as conditions warrant.

The chief features of construction of the truck, as may be noted from the accompanying illustration and drawings, are its simple construction, the facilities for its ready repair and the ease of getting at the journal boxes for oiling and inspection. It is built up of riveted steel channels, plates and angles. For the cross beam 12-in. channels were originally used, with the top flange cut off, but now 12-in. x 3/8-in. plates, 5 ft. 6½ ins. long, are used, with 3-in. x ½-in. angles at the bottom. For the sides 10-in. 25-lb. channels, 6 ft. 5 ins. long, are employed. The truck has 30-in. wheels, with a wheel base of 5 ft. 6 ins., with inside-hung brakes. The motors are also inside hung.

This truck is not expensive to build; has outside bearing boxes, which can be easily reached; is compact and easy riding. Its chief merit, however, lies in its low maintenance. In the four years that the company has used this type of truck, the cost of repairs has been less than on any of the other types in use; in fact, there is seldom more than one or two of these trucks in the shop for repairs at any one time.

WOOD SHOP

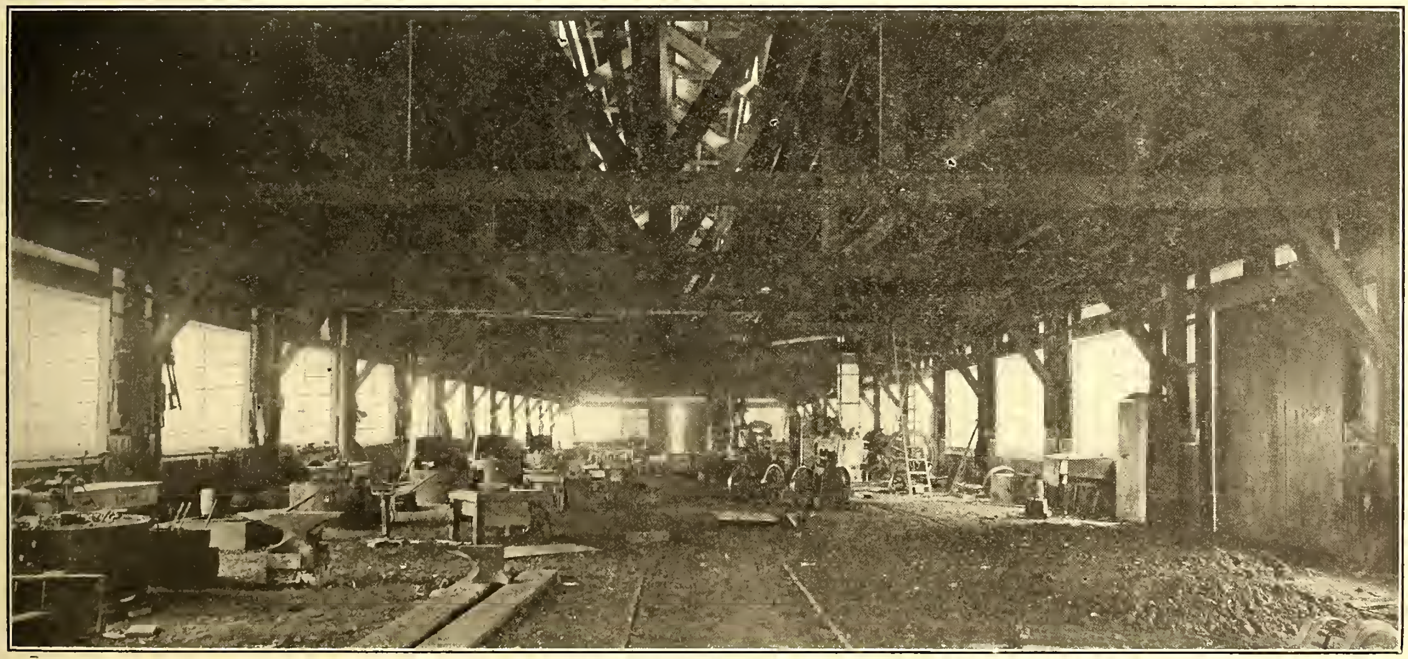
The wood or carpenter shop is built in between the truck room and mill, as shown on the plan. It is 210 ft. x 100 ft., and has thirteen tracks connecting with the transfer pit, five of which pass through the truck room. This arrangement is convenient for transferring cars directly to and from the car hoist without their passing out doors to the transfer table. In the wood shop is done all the body construction and bench work, also the necessary woodwork for the steamers, buildings, etc.



OIL FURNACE IN FORGE SHOP, OAKLAND TRACTION SHOPS

WOOD MILL

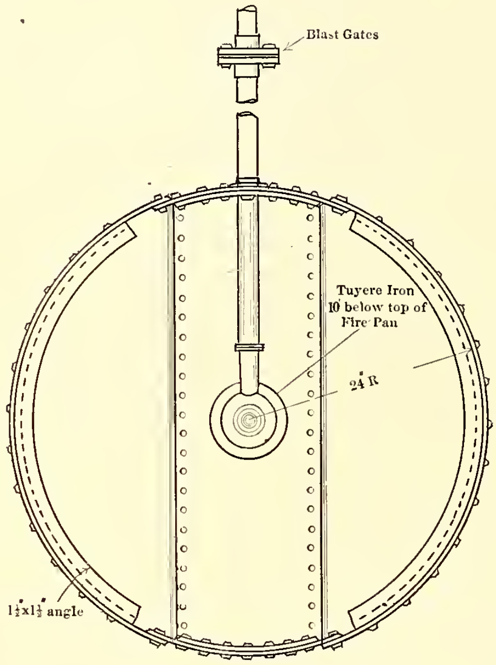
Immediately adjoining the carpenter shop and opening from it in an L on the southwest corner is the wood mill, a room 60 ft. wide and 120 ft. long. A feature of the north wall construction is doors which slide up to open. They are arranged in this manner to save room and to permit handling of material from the track outside directly into the shop. When open, the doors shut off the light from the windows above, but let an equal amount through the door opening. The window sash above the door is 10 ft. wide and 7 ft. high, the door being of the same width and giving an opening 7 ft. 9 ins. high.

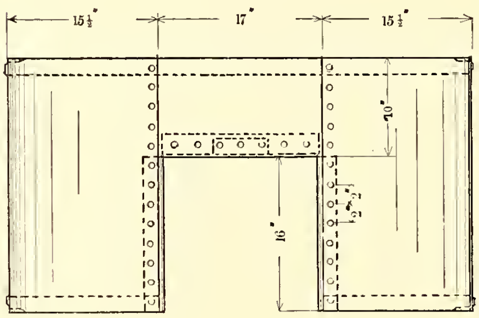


PARTIALLY EQUIPPED FORGE SHOP, SHOWING FORGES AT LEFT, OAKLAND TRACTION SHOPS

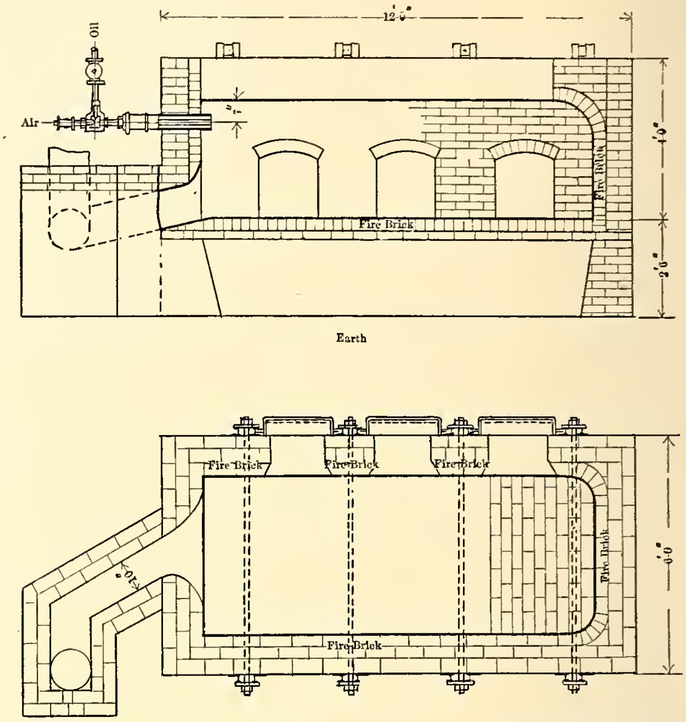
The wood mill is operated by two 50-hp, 500-volt motors, belted to line shafts. The floor of the shop is raised above that of the carpenter shop, and all the shafting and belting is placed beneath the floor. This arrangement gives a clear work room, and not only eliminates the danger from belting, but protects the shafts and motors from dust, and makes it easier to handle long pieces of lumber.

The equipment of the mill is very complete, and comprises all the woodworking machines necessary for the repair and construction of cars. Included in the equipment are a Fay & Egan double panel raiser, a patent foot miterer, an automatic sash and door clamp, an elbow power sander with 7-ft. swing,

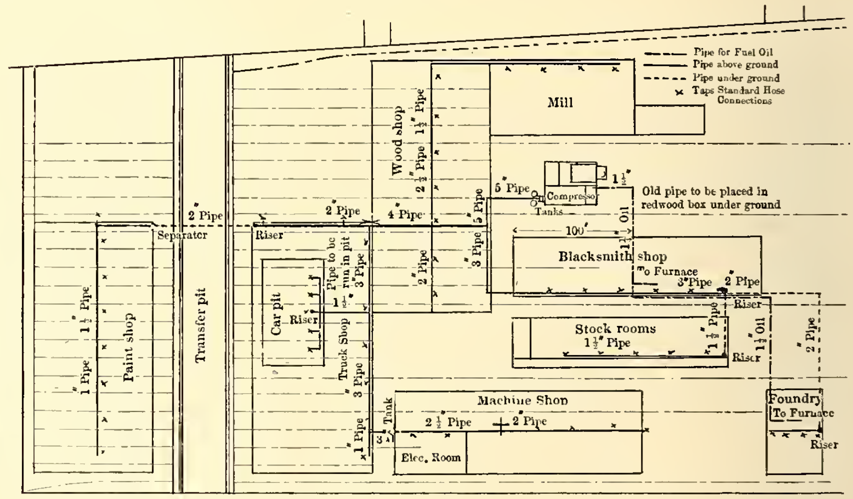




PLAN AND SECTIONAL ELEVATION OF BLACKSMITH FORGE, OAKLAND TRACTION SHOPS



PLAN AND SECTION OF SIDE ELEVATION OF OIL FURNACE IN BLACKSMITH SHOP, OAKLAND TRACTION SHOPS



PLAN SHOWING AIR AND OIL PIPING IN OAKLAND TRACTION SHOPS

a 36-in. carborundum planer-knife grinder, a Greaves & Klusman 16-in. joiner with 8-ft. table, a four-head six-roller Northwestern planer and matcher, an 8-in. x 26-in. American planer and matcher, a Baker combined rip and cut-off saw, a Powers tenoning machine, a 10-in. Porter double shaper, a 42-in. Hall & Brown band resaw, an 18-in. Fisher automatic cut-off saw, a Fay & Egan 40-in. cut-off saw, an 8-in. joiner, a 12-in. rip saw, a 32-in. band saw, a 7-in. Hall & Brown sticker, a 24-in. planer, a Smith mortising machine, a three-spindle American vertical borer, a Porter 26-in. pattern maker's lathe, a 30-in. Hall & Brown swing cut-off saw and a single-post boring machine. There is also a complete equipment of mill trucks for handling work. A kiln of suitable capacity is to be built west of the wood mill.

FORGE SHOP

The forge shop is a separate building, 60 ft. x 210 ft. in size, and is located at right angles to the truck and carpenter shops. Ample light is furnished by 1512 sq. ft. of glass. A ventilator on the ridge of the roof permits the escape of the gases and smoke.

The equipment consists of nine forges of special design—space being provided for the addition of as many more—a three-door oil furnace, a second furnace being installed, an 800-lb. steam hammer, a 2000-lb. steam hammer, a pair of power shears, a combined punch and shear, an oil rivet furnace, an oil-forging furnace, a pneumatic riveter, a No. 7 Ajax bulldozer and a carborundum car-wheel grinder. All the special track work is done in this shop, the work being laid out in the west end of the building.

The forges are spaced 20 ft. center to center along the south side of the shop, and are connected with the motor-driven blower by a pipe laid underground. This pipe varies in diameter from 14 ins. to 8 ins.; and connects with the individual forges through 45-deg. reducing branches. The forges are 48 ins. in diameter, and are built up of 3-16-in. sheet iron and

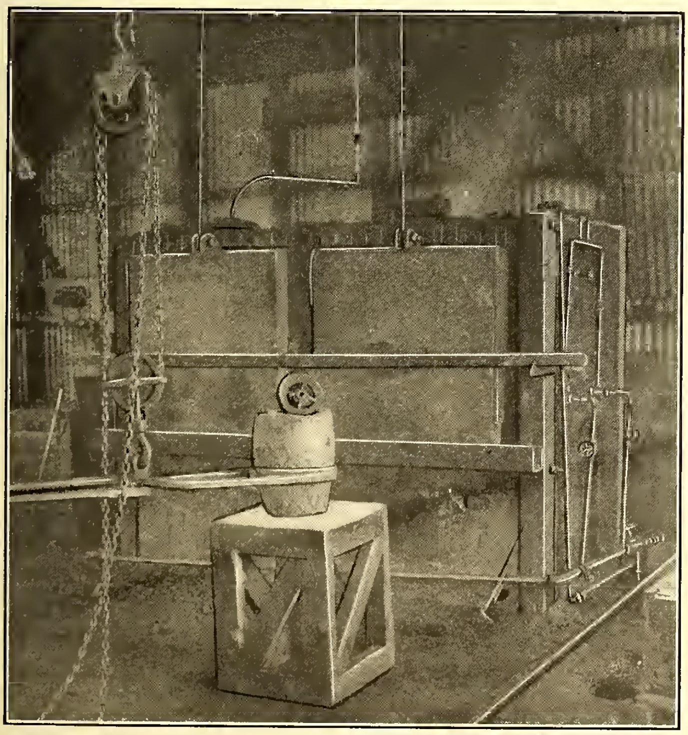
1½-in. x 1½-in. angles. The fire-box is 17 ins. wide, and the tuyere iron is located 10 ins. below the top of the fire-pan. One of the accompanying views shows the forging furnace recently installed.

OIL FURNACE

The oil furnace used for forging purposes is of large size and of a design not usually found in electric railway shops. Its general details of construction are shown in the accompanying illustration and drawings. In general dimensions it is 12 ft. long, 6 ft. wide and 6 ft. 6 ins. high above the floor line. It is built of brick, with the floor of the furnace 2 ft. 6 ins. above the ground floor of the shop. The brick walls are carried down to the ground, and the space beneath the furnace floor is filled in with earth. The interior is 4 ft. wide, 10 ft. long and 3 ft. 7½ ins. high to the center of the arch. It is lined with fire-brick. There are three openings, each 18 ins. wide and 20 ins. high. The doors are 23 ins. wide, 25 ins. high and 5 ins. deep. They are of cast iron and lined with fire-brick. At the sides of the doors are attached 3-in. iron rollers which serve to guide the door when raised and lowered, between vertical 40-lb. T-rails serving as guides. Counterbalancing weights are connected to the doors by means of levers which lead to overhead handles 10 ft. in front of the doors.

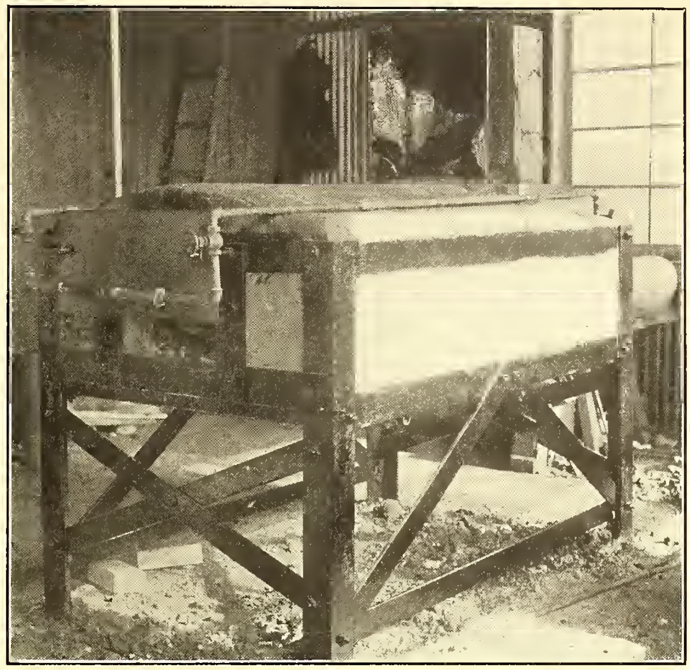
As fuel oil is much cheaper than coal in California, its use for a furnace of this character was, of course, predetermined. Additional reasons for its use were the favorable experiences of the large steam railroad companies and manufacturers on the coast with oil furnaces. Oil has not only proved to be the cheaper fuel, as well as the most convenient to handle, but uniformly better results have been obtained when the metal has been heated with oil.

The type of burner is one that has been adopted by some of the largest metal workers on the coast, and although simple in



OIL FURNACE IN BRASS FOUNDRY, OAKLAND TRACTION SHOPS

construction has proved to be very well adapted for the work. The blast is delivered to the burner by a separate motor-driven blower through a 4-in. pipe, a blast gate affording means for regulating the blast. Air for the atomizer is taken from the blast pipe through a 1-in. pipe with a 45-deg. Y branch. The oil supply is earried through a 1-in. pipe, connecting with the atomizer at right angles to the air pipe. Short lengths of 1-in. brass pipe with eonieal ends are inserted in both pipes, the blast striking the oil at right angles and thoroughly atomizing it. The burner proper consists of a 4-in. blast pipe, with a 1-in. wrought-iron pipe centered in it, the blast serving to carry the flame over the top of the furnace and back onto the metal to be



OIL FURNACE FOR LIGHT FORGING WORK, OAKLAND TRACTION SHOPS

heated. The smaller pipe passes through a brass bushing and terminates 1½ ins. from the end of the 4-in. pipe, whieh in turn projects 4 ins. inside the furnace wall. The temperature in the furnace with this type of burner can be regulated as required. A 4-in. car axle can be brought to a white heat in eight to ten minutes.

MACHINE SHOP

The machine shop, located on the north side of the grounds, is 70 ft. wide and 210 ft. long. In the northeast corner is an armature shop 35 ft. x 60 ft. The building is heavily trussed with double cross braces as in the truck room, so as to provide suitable support for the cranes and line shafting. The floor is double, and consists of 3-in. and 1⅛-in. tongue and grooved Oregon pine flooring, laid on 4-in. x 6-in. redwood stringers which rest on concrete walls. As with the other buildings, this shop is exceedingly well lighted, having 2916 sq. ft. of glass in the windows and 1485 sq. ft. of roof lights.

All the machinery is driven from two 3-in. line shafts, 200 ft. in length, that receive power through a 4-in. jack shaft from a 120-kw T-H. multipolar generator, operating as a motor. This motor is located in the east end of the shop, near the point of heaviest load. The line shafting method of operation was selected as being the best adapted for the requirements of the shop, especially in view of the fact that the company already had the generator on hand.

A special switchboard was built to serve as a starting panel. It was constructed on an iron frame and contains a circuit breaker, ammeter, special starting switch and shunt-field rheostat. For a starting box an old car rheostat was brought into service, the spider being cut out and terminal plates substituted for the contact plates. The starting switch is arranged with four points so that the four sections of the rheostat can be thrown into circuit as neeeded to build up the current in starting.

The equipment of the machine shop comprises all the tools and machines necessary for the repair and construction work for the two railway systems, including that for the power houses and for the ferry boats of the Key Route. The heavier machines are located in the southeast corner, where they are served by a track running in from the truck shop. A Bement-Niles axle lathe is placed near the door. It is the practice of the company to roll all axle journals in order to close the grain of the metal and increase their wearing qualities. Next is a hydraulic wheel press, with special fittings, and opposite is a 42-in. Niles steel-tired car-wheel lathe. The company turns all its Key Route wheels on this lathe. A 42-in. Niles car-wheel boring machine is also provided. The remaining equipment in this shop includes eight machine lathes, two planers, six drill presses, two shapers, two bolt cutters, a pipe-cutting and threading machine, a 24-in. cold metal saw, a special Morse twist-drill grinder and three carborundum grinding and polishing sets. Each of the lathes is served by a jib crane with pneumatic hoist. Tires are heated for replacing on car wheels by means of gas flames issuing from holes in circular pipe that surrounds the tires. A tire can be put on in this manner in from ten to thirteen minutes. The gas is generated in a tank from gasoline with the aid of air at about 40 lbs. pressure. A similar gas generator is used for burning off paint. In the center of the shop is a tool room, all tools being issued on a check system.

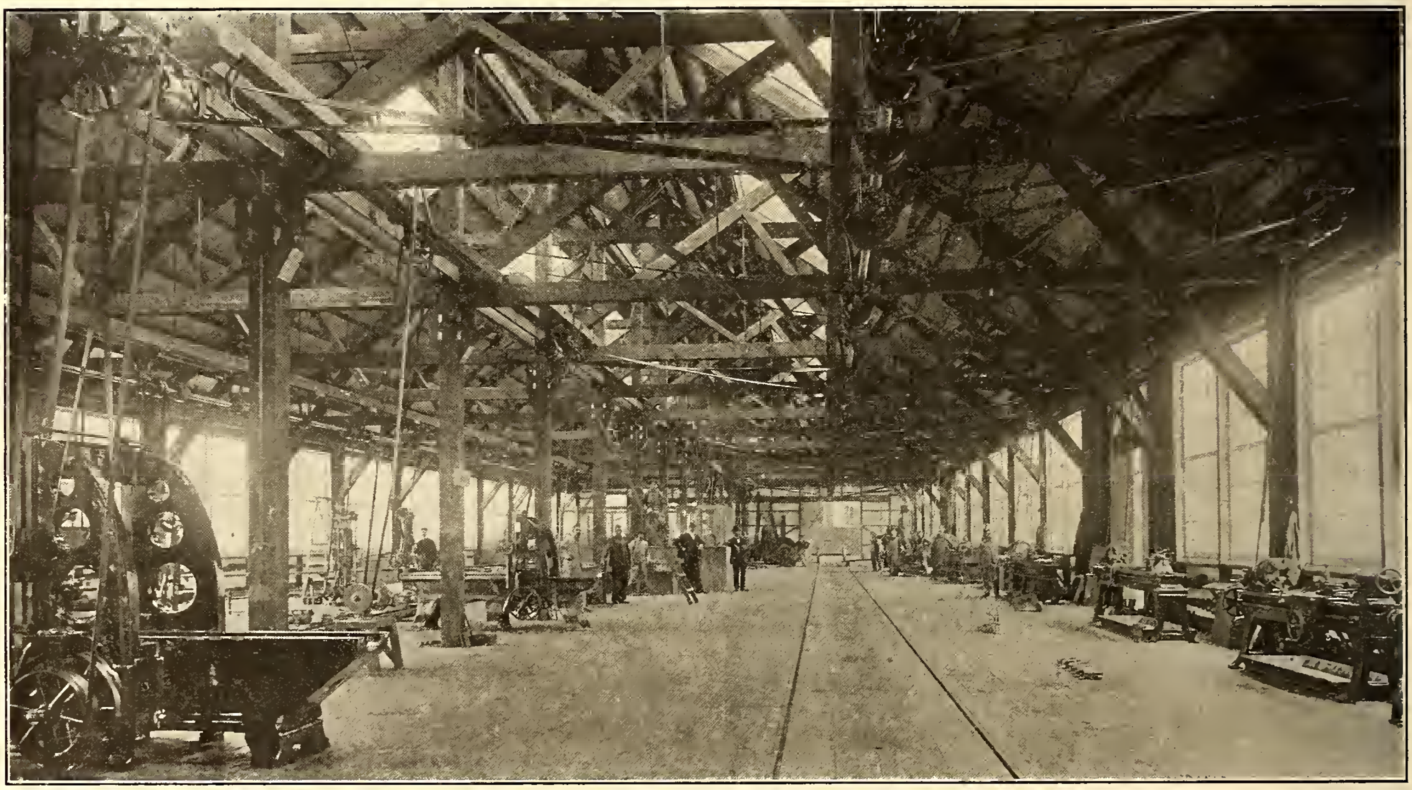
All the construction work on the diamond-shaped trolleys used on the Key Route cars is done in this shop. The illustration on the opposite page shows several of these trolleys under construction. Some of the brass contact rollers can be noted in the foreground.

ARMATURE ROOM

The armature room in the northeast corner of the machine shop is arranged for making all armature, field coil and general electrical repairs. It is to be served by a crane with air hoist, traveling the length of the room. The shop is equipped with a large electric oven, a special field-winding machine, an armature lathe, electric testing circuits and the other tools necessary for a shop of this kind.

The electric oven is 3 ft. 7⅛ ins. high, in the clear, and 4 ft. deep. It is divided into three compartments, and is 14 ft. long over all. The rear and side walls are built of two layers of fire-brick. The top of the oven consists of 3½-in. T-rails, laid across the oven on 14-in. centers and filled in with 12-in. x 12-in. x 2-in. fire tile, topped with concrete. There are three sets of double doors, built up of plates and angles on channel-iron frames. The doors are held shut by means of suitable catches. An opening 3 ft. 10 ins. wide is provided for each section when the doors are open. A track with a 3-ft. gage enters each oven so that trucks with heavy armatures may be rolled in on trucks.

The electric heaters for the oven are two in number, and are built in vertically between the sections. Each heater consists of seven 1-in. gas pipes, 3 ft. 9 ins. long, covered with two layers of 1-16-in. sheet asbestos, shellaced and wound with No. 21 annealed iron wire, seven turns to the inch. The wire is 0.032 in. in diameter and is tinned. The rods or pipes are spaced 6 ins. apart and are held by ⅜-in. special wrought-iron clamps, fastened to the tie-rods of the furnace at the top and bottom. The clamps are bolted together by ⅜-in. and 1½-in. bolts.



MACHINE SHOP, OAKLAND TRACTION SHOPS

Current for the heaters is taken from the trolley supply through a 30-amp. fuse to a snap switch and to a double-pole double-throw knife switch, by means of which the current can be sent through the two heaters in series or in parallel, and thence to ground. A current of 14 amps. is required for operating the two heaters in parallel. An armature can be baked thoroughly in the oven in about 24 hours.

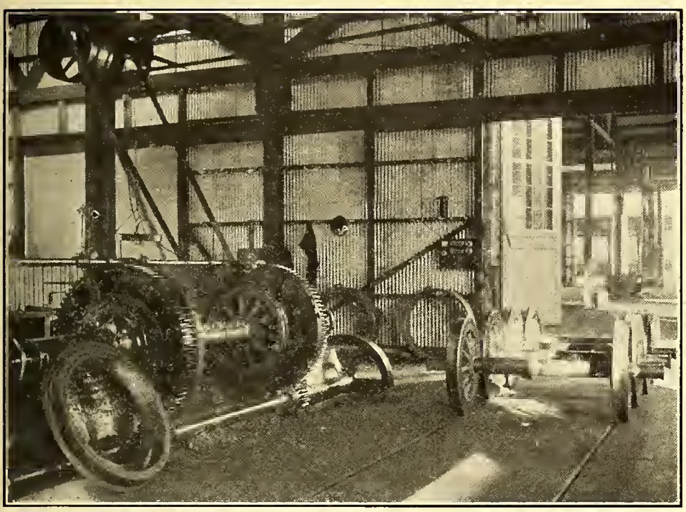
BRASS FOUNDRY

To the west of the machine shop is located the brass foundry in a separate building 30 ft. x 50 ft. In this building are made all the brass and bronze castings used by the Oakland Traction Consolidated and the San Francisco, Oakland & San Jose Railway. It is equipped with a double-door oil furnace, benches, bins, shelves and the necessary foundry tools. A revolving brass furnace is soon to be constructed in the foundry.

The brass furnace has outside dimensions of 7 ft. 3 ins. wide, 3 ft. 3 ins. deep, and 5 ft. 6 ins. high. It is built of red brick walls, with the bottom of the furnace 30 ins. above the floor, the space between being filled with earth rammed in. The furnace is lined with fire-brick and has two arches. Angle irons at the corners with cross bolts serve as a structural frame work. Crude oil is burnt as fuel, the compressed air from the shop system being used for the blast. The fnrnace has a capacity of 350 lbs. of metal melted in an hour.

STOREROOM

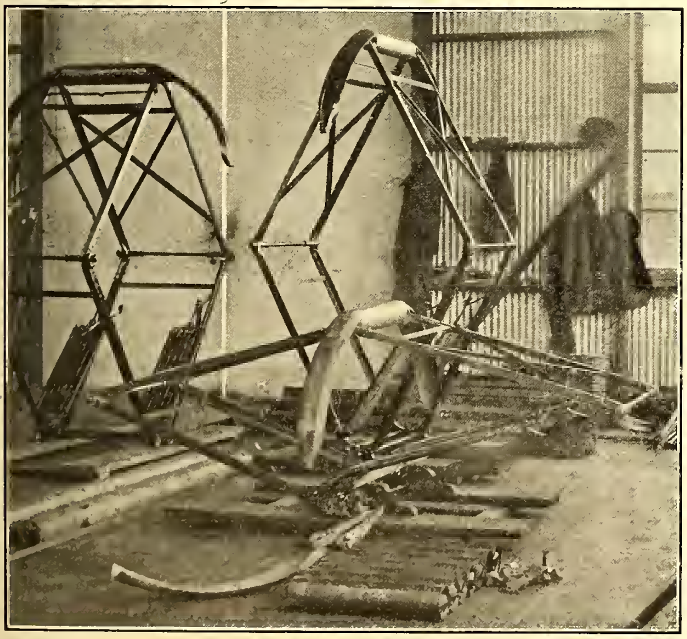
Located between the forge and machine shops and convenient to all the buildings is the storeroom. It is 35 ft. wide and 165 ft. long, and has a second floor lighted by skylights. At



CORNER OF MACHINE SHOP, SHOWING WHEEL LATHE, OAKLAND TRACTION SHOPS

the east end of the building are the offices of the master mechanic. The location places this official practically in the center of the entire system of shops, so that he can easily supervise the work in all departments. This arrangement has been found to work out better than having the offices at the entrance to the grounds or at any point on the edge of the shops.

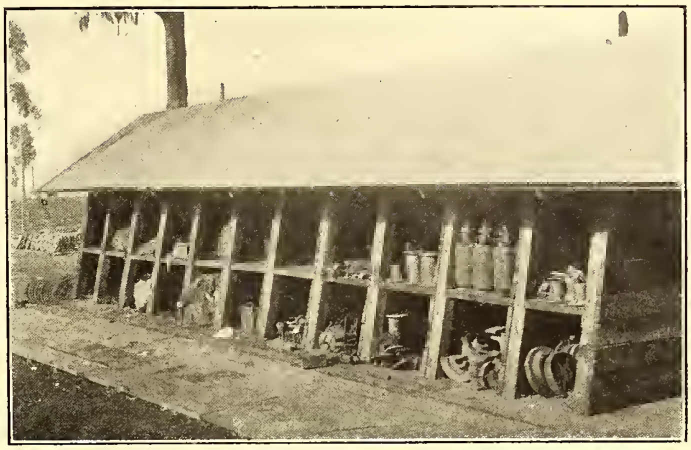
The first floor of the stock room is raised to the level of a flat car, and along the north side is an 8-ft. platform to facilitate unloading from the cars. Inside there are provided some 3600 bins of different sizes and 480 drawers for various over-



DIAMOND TROLLEYS UNDER CONSTRUCTION, BRASS CONTACT ROLLER ON FLOOR IN FOREGROUND, OAKLAND TRACTION SHOPS

head track and shop supplies. There are also a large glass rack, a case containing shelves and drawers for canvas, cloth and curtains, a case for fiber, asbestos and stencil board, a large broom rack and other divisions for necessary stores. The bins for screws are painted yellow for brass, blue for blue-headed and white for plain iron screws, to facilitate finding the ones wanted. An elevator serves to carry the stores between the first and second floors. In the center of the building is located the storekeeper's office. Goods are only delivered on requisition signed by shop foremen.

For heavy stores outside bins and racks are provided. These include a large covered rack open at the ends for bar iron and steel, covered bins for scrap material and sheds for lumber storage. Ties and rails at present are stored in the yard of the

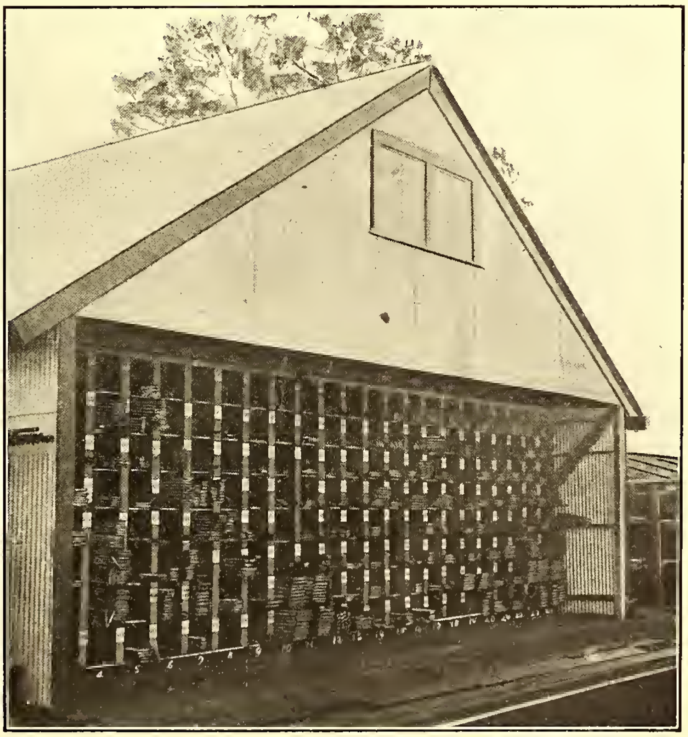


COVERED STORAGE BINS FOR HEAVY SUPPLIES, OAKLAND TRACTION SHOPS

power house, where ample room is provided. Covered bins are used to store heavy metal supplies and miscellaneous articles that would otherwise be scattered about the yards.

RAIL HOIST

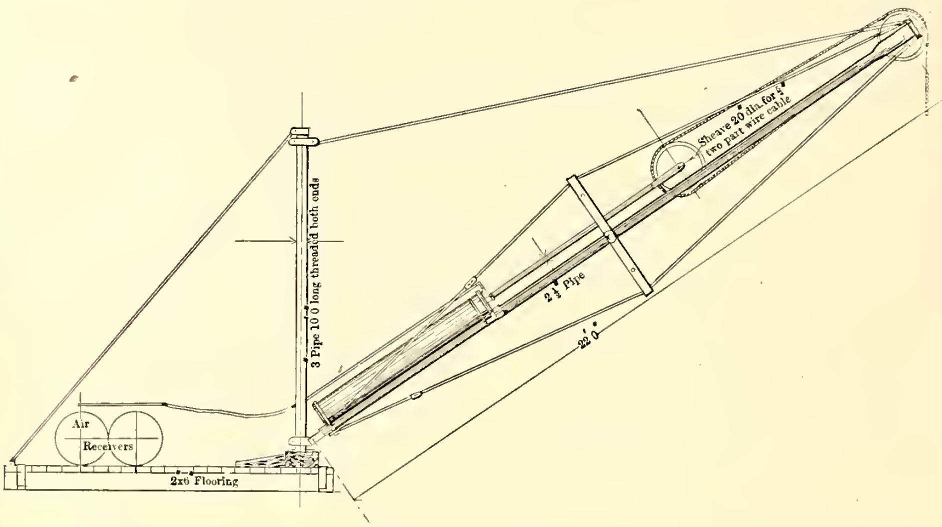
A device which has proved to be of great service to the company is a rail hoist or loading machine. The hoist was designed



COVERED RACKS FOR STORING IRON AND STEEL STOCK, OAKLAND TRACTION SHOPS

by the company's eng neer and built in the shops. It consists of a 23-ft. jib crane, with pneumatic hoist, mounted on a platform on one end of a flat car. It is of built-up construction, the vertical mast consisting of a 3-in. pipe, 10 ft long, secured by rear braces and supporting the jib by a ¾-in. rod, 18 ft. 6 ins. long. The jib consists of a 2½-in. pipe, 22 ft. 8 ins. long, cross braced at the center and guyed by four ⅝-in. rods provided with turn buckles.

An air cylinder, mounted on the jib by wrought-iron bands, consists of a 7-in. pipe, 6 ft. 6 ins. long, bored out for the piston head. The air piston is a 1½-in. cold-rolled steel shaft, and bears at its outer end a 20-in. sheave, adapted for a two-part wire cable. The cable, the end of which is secured to the outer



DETAILS OF RAIL HOIST FOR UNLOADING RAILS, OAKLAND TRACTION SHOPS

end of the jib, passes over this moving sheave, and also a 17-in. sheave fixed at the end of the crane.

The step-bearing at the foot of the vertical mast was made by screwing a coupling on the 3-in. pipe and then a plug into the coupling. The coupling is finished on the outside and the plug is faced off to the coupling. A piece of brass is inserted in the bottom of the hole in the wooden block for a bearing plate.

The crane has a movement in the horizontal plane so that rails can be easily picked up off a car and swung around and unloaded, or vice versa, if the rails are to be loaded. It has a lifting capacity of about 1000 lbs., and does the work, with a crew of four or five men, that generally requires the services of about twenty men. In addition, it does the work very much more quickly and to better satisfaction. Three rails per minute can be loaded or unloaded with the apparatus. Air is furnished to the hoist from receivers that are charged from compressors mounted on the rear of the car.

SHOP, POWER HOUSE AND COMPRESSED AIR PLANT

Between the wood mill and the forge shop is the power house, a building 35 ft. x 45 ft. in size. The equipment supplies compressed air and steam for the shops. All the electric current for power and lights is taken directly from the 600-volt feeder system from the Key Route power house.

In the boiler room are two 125-hp Babcock & Wilcox boilers, arranged for burning crude oil. One boiler is also equipped for burning shavings, as it is the intention to install a shaving exhaust system in the wood mill which will carry the sawdust and shavings to a bin above the boilers. A 2000-gal. tank for crude oil storage is located under ground outside the power house.

In the engine room is a vertical compound 200-hp engine, belted to a tandem-compound air compressor. Air storage capacity is provided in two tanks, 36 ins. in diameter and 13 ft. 6 ins. long, located east of the power house. From these tanks a piping system runs to the stock room and all the shops, starting with a 5-in. main and distributing through 1-in. 1½-in. and 2-in. pipes. An auxiliary storage tank, 5 ft. in diameter and 13 ft. long, is located between the truck room and the machine shop. A pressure of 80 lbs. is maintained on the system. In the car pit in the truck room five risers are provided for blowing out armatures and cleaning purposes. Complete equipments of air tools are provided throughout the shops, including riveters, hoists, hammers, air blasts, etc.

An oil-distributing system is also provided, leading by a 1½-in. pipe from the oil pump in the power house to the forge shop furnace, and thence by a 1-in. pipe to the furnace in the foundry. The pipe is laid underground in a redwood box. Exhaust steam from the compressor engine and pumps will be used for heating the lumber kiln, and live steam will also be utilized when needed.

WATER AND SEWER SYSTEMS

Water for fire protection and general supply is taken from the Contra Costa Water Company's city system, a 4-in. main connecting with all the buildings. In each shop several hose stands are provided, with 2½-in. cotton fire hose, so that nearly any spot can be reached by two lines of hose. Drainage from the roofs and buildings is provided for through 8-in. and 10-in. pipes, connecting with a large city storm sewer which is laid along the south side of the property. The transfer pit is drained by a separate system to avoid its filling up in case the roof sewer should become filled and back up.

THERMIT JOINTS

The company has just decided to install thermit rail-joints on a large scale, and has ordered 1400 welding portions from the Goldschmidt Thermit Company, of New York.

CONCLUSION

The shops were erected under the supervision of J. Q. Brown,


RAIL HOIST FOR UNLOADING RAILS, OAKLAND TRACTION SHOPS

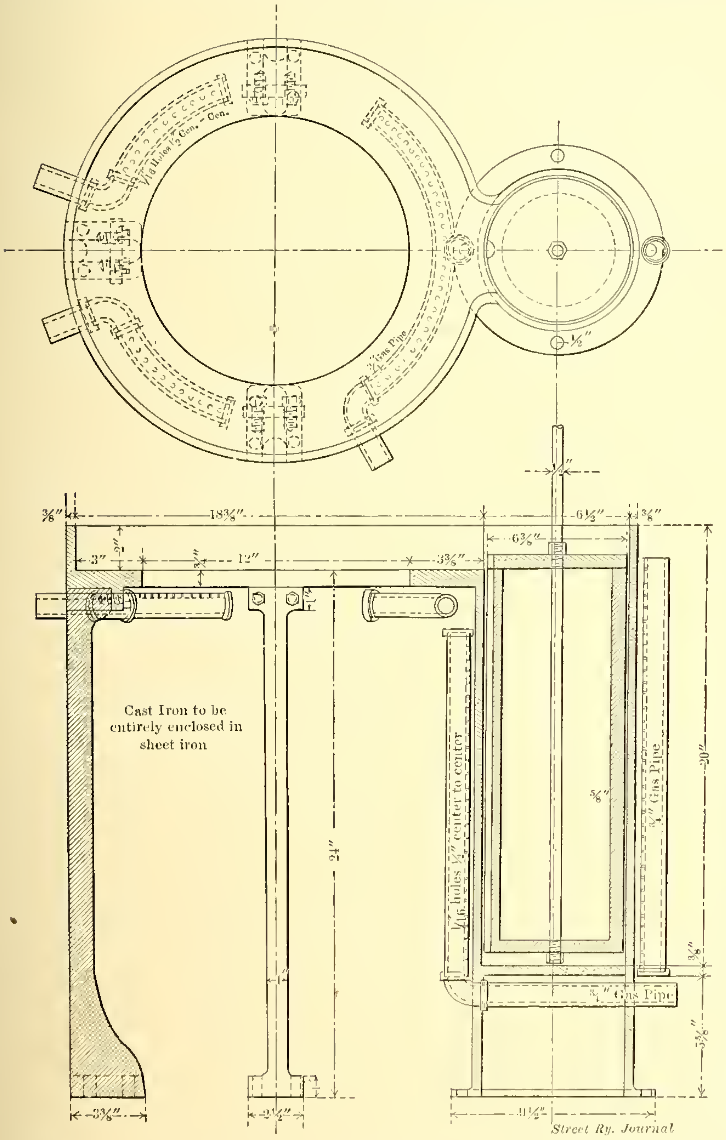
assistant general manager and chief engineer for both companies. Mr. Brown has given his personal attention to the construction of the shops, and the general plan as well as many of the details were put in according to his design. H. L. Griswold, Mr. Brown's assistant, has had immediate charge of the drawing of the plans, and has also worked out several of the original features of design. The master mechanic of both companies, whose ideas also were embodied in the general arrangement and who now has direct management of the shops, is George St. Pierre.

It is the intention of the companies not only to carry on all repairs to its cars in the shops, but also to build its own cars complete, work along the latter line having already been begun.

Acknowledgments of thanks are due to J. Q. Brown, F. W. Frost, H. L. Griswold, George St. Pierre and other officials of the Oakland Traction Consolidated for data, photographs and drawings used in the preparation of this article, and for many other courtesies extended.

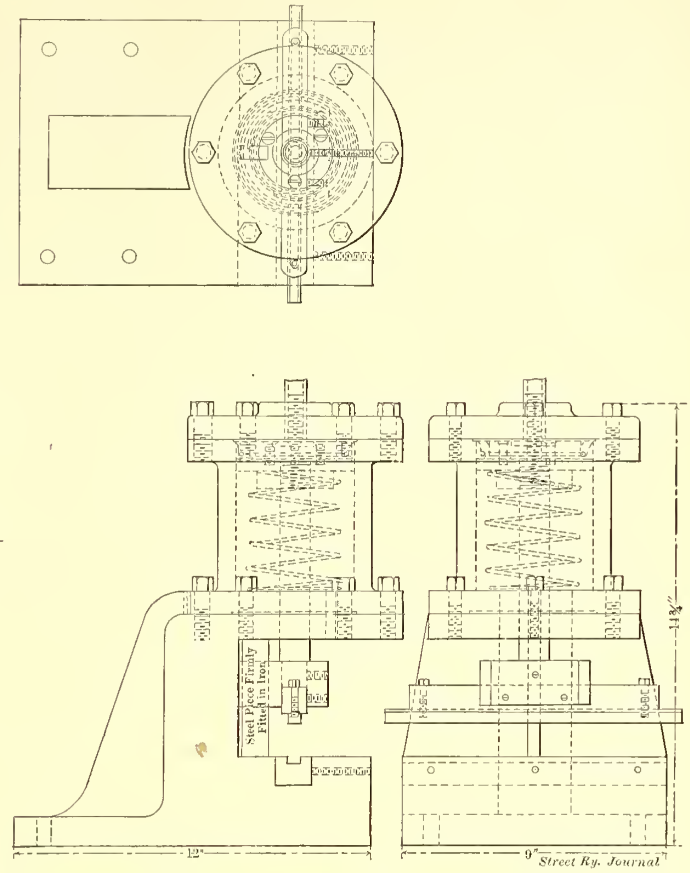
ARMATURE SOLDERING OUTFIT AND COIL PRESS AT DETROIT UNITED SHOPS

Through the courtesy of Sylvester Potter, master mechanic of the Detroit United Railway, the accompanying descriptions and drawings are given of a soldering outfit for soldering armatures, and pneumatic press for pressing armature coils into shape, both of which devices have been recently developed at the Detroit United Railway repair shops:



ARMATURE SOLDERING OUTFIT, DETROIT UNITED RAILWAY SHOPS

The armature soldering outfit, as indicated on the drawing, consists of a reservoir for hot solder and a shallow basin with a hole in the center. This hole is of sufficient size to allow the largest commutator to pass through until the slotted flange rests on the bottom of the basin. When it is desired to solder an armature, it is picked up by an air hoist, an asbestos ring is placed around the commutator tight against the slotted flange and the armature is set in place on end in the basin. Heat is then applied by jets of flame from a number of small holes in a ring of pipe encircling the commutator. When the commutator is heated sufficiently, the joints are well cleaned and solder is forced from the reservoir into the basin by screwing the plunger to the depth desired. The asbestos ring, held by the weight of the armature, keeps the solder from running through the hole in the center.



PNEUMATIC COIL PRESS, DETROIT UNITED RAILWAY SHOPS

When the connections are soldered, the surplus solder is allowed to run back into the reservoir and the armature is removed. The solder in the reservoir is melted by a single burner near the bottom. A mixture of gas and compressed air is burned, both for this purpose and at the commutator heating ring. To solder the smaller armature, there is kept in stock a number of plates, with holes of various sizes, to place in the basin for the purpose of supporting armatures of different diameters and designs.

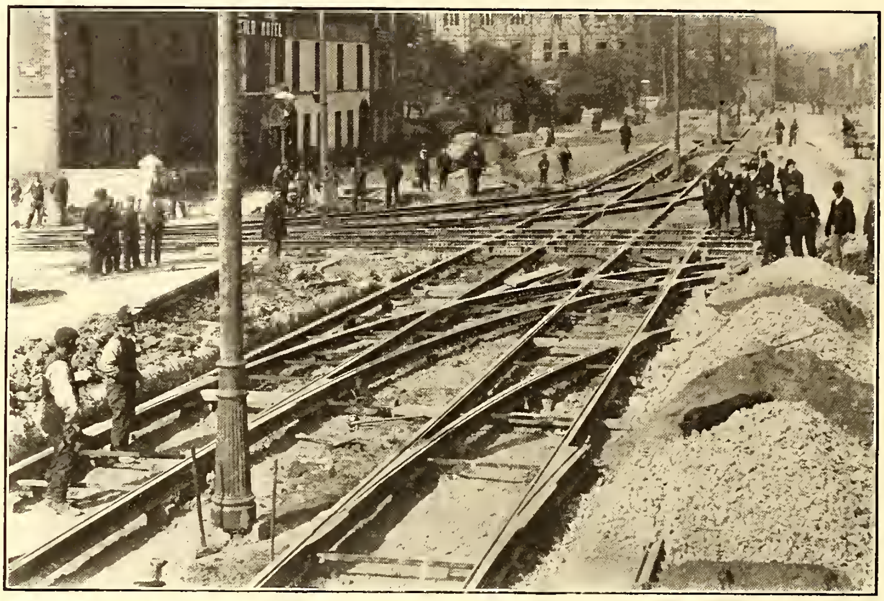
The pneumatic armature coil press is used for pressing armature coils into shape after they have been formed. The press is operated by admitting air at the top from the shop storage-tank system by means of an ordinary motorman's valve. The air thus admitted forces the piston downward, together with the die attached thereto. The die fits into a slot in the base, flattening out the coil as desired. Dies and slots to suit different types of coils are made to fit the press.

One boy operates two of these presses, pasting the paper and placing a coil in one press, while the other press keeps another coil under pressure and allows the paste to set firmly.

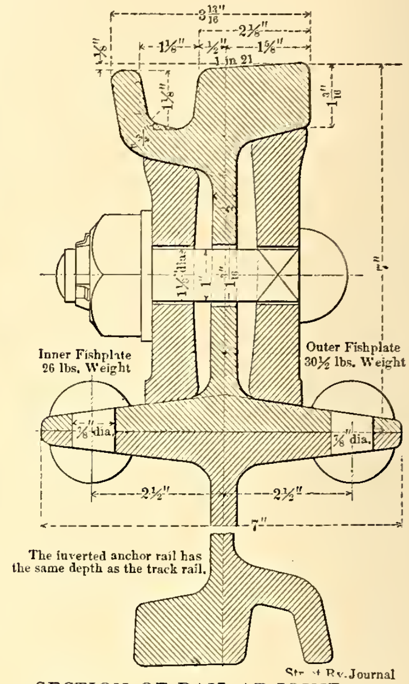
Four interurban baseball leagues are being formed, one in Northern Indiana, overlapping into Michigan; one in the gas belt; one in the Lebanon-Crawfordsville district, and one in the Princeton-Evansville district.

THE BELFAST TRAMWAYS

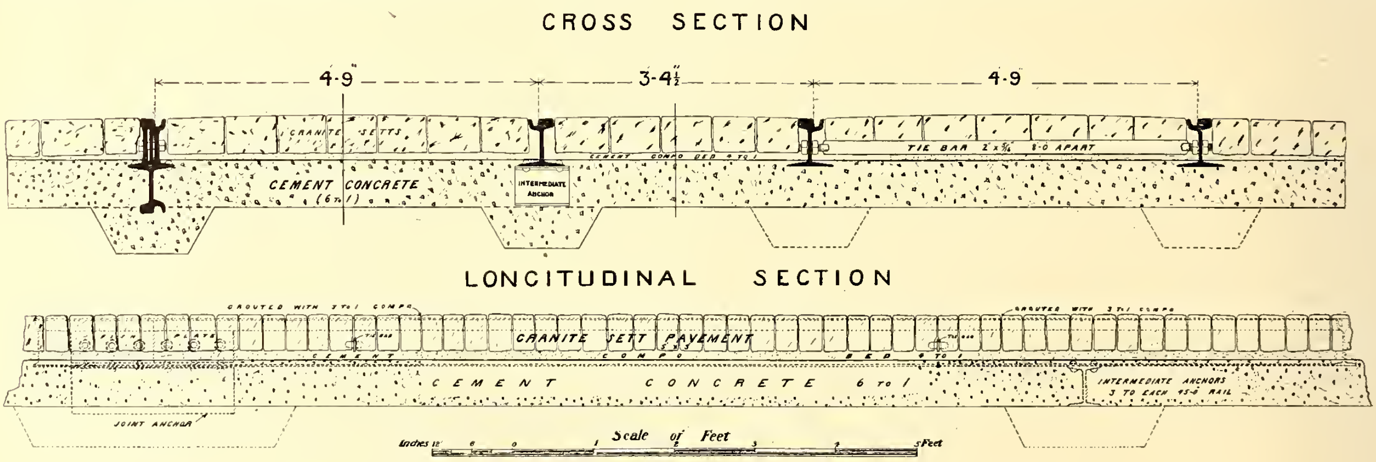
The tramways in Belfast were the last of those in any large city in the United Kingdom to be changed from horse to electricity, and the new electric system has just been completed. Belfast had a population in 1901 of 350,000, and the first tramways in the city were put in operation in 1872 by the Belfast Street Tramways Company. In 1893 the city, by the twenty-one-year act, was permitted to purchase them, but instead continued the company's lease for fourteen years. By subsequent agreement this was reduced to twelve years, and the city entered into possession of the system early last year. At that time there were 35 miles of track, all of which were being worked by horses. The amount paid by the corporation to the Belfast Street Tramways Company for its undertaking was settled by arbitration, and the amount awarded by the arbitrator, L. L. Macassey, including the value of three years unexpired lease and compensation to officers, was £364,448.



VIEW OF THE TRACK LAYOUT AT FISHERWICK PLACE AND GROSVENOR ROAD



SECTION OF RAIL AT JOINT



CROSS AND LONGITUDINAL SECTIONS OF BELFAST TRAMWAYS ROADBED

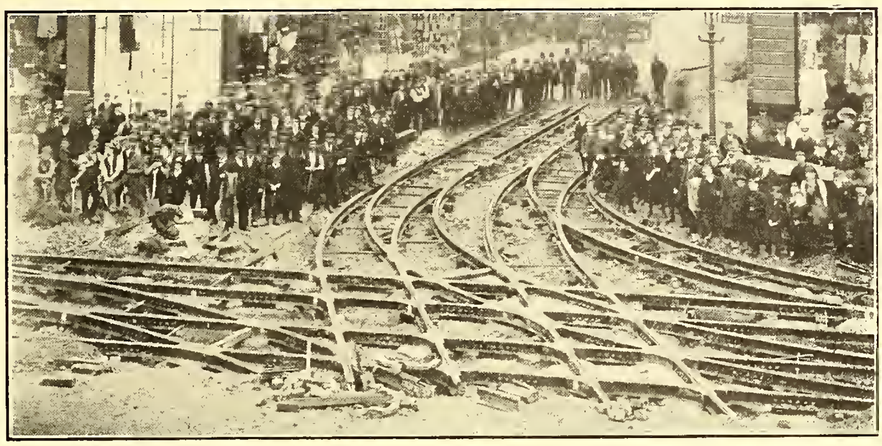
In July, 1904, Henry A. Cutler, M. Inst. C. E., the city surveyor, and V. A. H. McCowen, M. Inst. E. E., the city electrical engineer, reported to the newly-formed tramways committee of the corporation on the various systems of electric traction, and strongly recommended the adoption of the overhead trolley system. This report was adopted, and Mr. Cutler was instructed to prepare drawings and specifications for the permanent way and the buildings; Mr. McCowen to prepare a scheme for the electrical operation of the system, including specifications for the generating plant, cables and overhead equipment; and Mr. Nance, who had for many years managed the horse tramway system under the old company and had been appointed manager for the corporation, to prepare a specification for new rolling stock, and to make the necessary alterations and additions to the car sheds and depots. After the specifications had been submitted to Lacy, Sillar & Leigh for expert advice, tenders were invited for the work of reconstruction of the tramways, excluding the buildings, in six different sections, and eventually the tender of J. G. White & Company, of London, for the whole of the six sections, amounting to £543,404, was accepted.

PERMANENT WAY

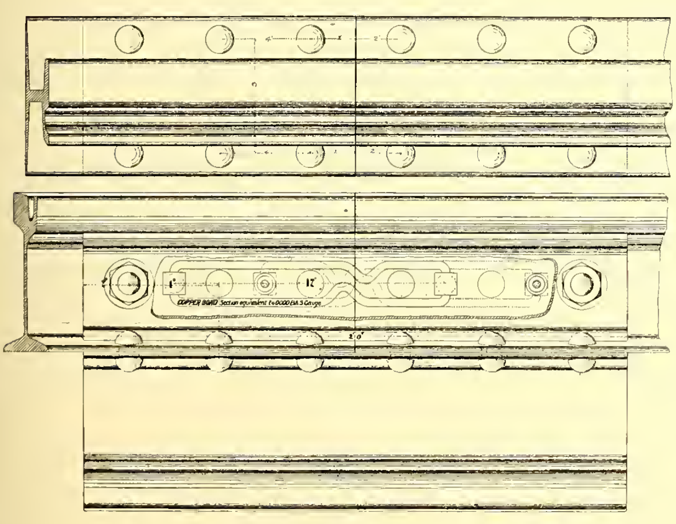
All the routes were laid as double line to a gage of 4 ft. 9 ins., and the work now completed consists of about 80 miles, measured as single track. Sixteen single-track miles of the tramways were laid only five years ago, and as this portion of the work was in fair condition, the renewal of the special work, bonding and general repairs was the only work necessary in connection with them. British standard sections were adopted for the rails and fish-plates used in the new track. No. 4 section, weighing 105 lbs. to the lineal yard, was used on the straight and flat curves, and No. 4C section, weighing 111 lbs. to the lineal yard, on curves of 66-ft. radius and under. The rails were manufactured by the North Eastern Steel Company.

Bridge joints are used, consisting of 2-ft. lengths of rail inverted and riveted to the under flange of the rails, with twelve rivets at each joint. Attached to the rail between the joints are intermediate anchors spaced about 11 ft. apart, consisting of sections of steel joists 8 ins. long riveted transversely to the under flange, with four rivets to each anchor. The tie-bars are of mild steel, 2 ins. x ¼ in. The joint bonding has been executed with two 0000 B. & S. gage copper bonds of the protected type. Solid crown cross bonds have been put in at 40-yd. intervals in the tracks and 80-yd. intervals between the tracks.

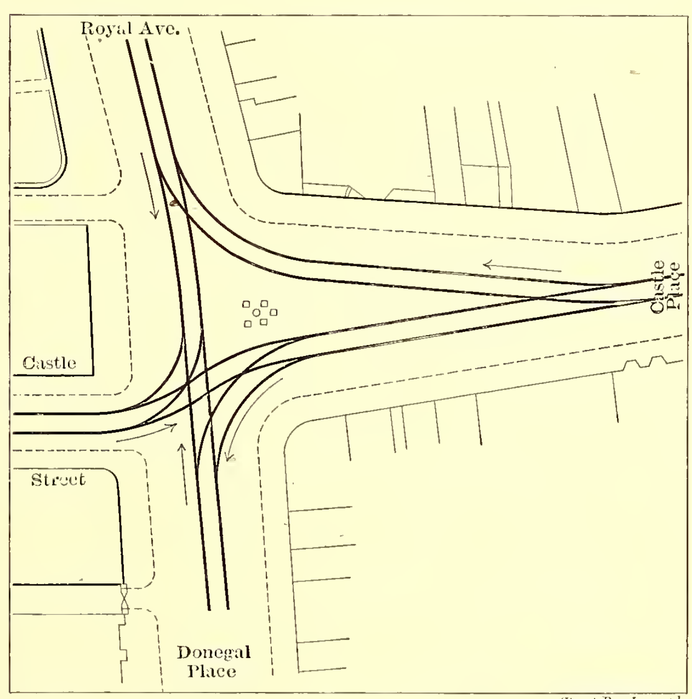
All of the special work was supplied by the Lorain Steel Company. The switches at junctions are made to a radius of 150 ft., and are fitted with manganese steel insert pieces. The crossings are of the iron-bound type, with steel armored centers. The special work was manufactured and fitted together at the company's works in America and delivered on the ground ready for laying. The care with which the work had been designed and manufactured enabled it to be put together on the site without the slightest trouble. Owing to the close spacing of the rail anchors, it was possible for some modifications of the usual method of track laying to be made, and do away with the necessity for removing temporary rail packings after the concrete had been put in. The method of track laying adopted was to align the rails and then put in the concrete packing. The concrete under the rails consists of broken stone, gravel and cement, mixed in the proportions of 6 of the aggregate to 1 of cement. Its normal thickness is 7 ins., and the upper surface was finished 1 in. above the rail bed. Where the foundation was considered unreliable, the thickness of the concrete was increased, in some places to as much as 12 ins. The paving consists of granite blocks, 5 ins. to 5½ ins. deep and 3 ins. to 4 ins. wide. They are laid on a dry compo bed, mixed in the proportions of 4 of sand to 1 of cement, which was thoroughly wetted after the paving had been laid. The joints were then grouted up with 3 to 1 compo, and back washed after the paving blocks had been rammed. In the greater part of the work the rails were not parged, as the grouting was found to fill the space between the paving blocks and the web of the rail, and to make a more satisfactory job. In some places where it was necessary to turn the traffic on the road immediately after completion, such as at road crossings, the rails were parged, the block bedded on sand, the joints racked up with chippings and grouted with pitch and creosote oil.



SOME SPECIAL WORK AT CASTLE JUNCTION ON THE BELFAST TRAMWAYS SYSTEM



SIDE ELEVATION AND PLAN OF JOINT



PLAN OF SPECIAL TRACK WORK AT DONEGAL PLACE

POWER STATION

The contract for the power station building was let to local contractors. The site of the building adjoins the electric light station and is very centrally situated, close to the bank of the River Lagan, which is navigable for barges to the site of the works, and will provide an unfailing supply of water for condensing. Work was commenced in April last, and owing to the soft nature of the ground, some 1750 piles had to be driven through 30 ft. of river mud down to the rock. The foundations on top of the piles are formed with cement concrete, in which is embedded a steel grill work made of old tram rails. The new building is faced with red brick, with stone dressings. The floors in the basement are formed of concrete, and the stoking floor and switch gallery floors are of concrete on steel joists. The stoking floor is finished with blue paving bricks; the switch gallery floors with vitreous glass mosaic, and the floor of the engine room with encaustic tiling. The walls of the engine house and switch galleries are faced with glazed tiles.

PUMP HOUSE

The pump house is 68 ft. long and 16 ft. 6 ins. wide, and is of red brick, with stone dressings. The pump wells are built in concrete, faced with blue brick, and the openings to the river are protected with movable screens. The pumps are carried over the pump wells on steel joists, and the floor is constructed of concrete and paved with tiles.

ELECTRICAL EQUIPMENT

As the railway station forms an extension of the existing lighting station, which was erected in 1898, all the plant installed has been arranged for both lighting and traction supply. The new generators have therefore been provided with compound windings for tramway supply at 550 volts, and can supply lighting current at 440 volts to 500 volts on the outers of the three-wire system. The plant in the original station consists of high-speed dynamos, with a total capacity of 3400 kw. The engines throughout are of Belliss & Morcom's make, and three of the large lighting generators can be run on the tramway load, if required.

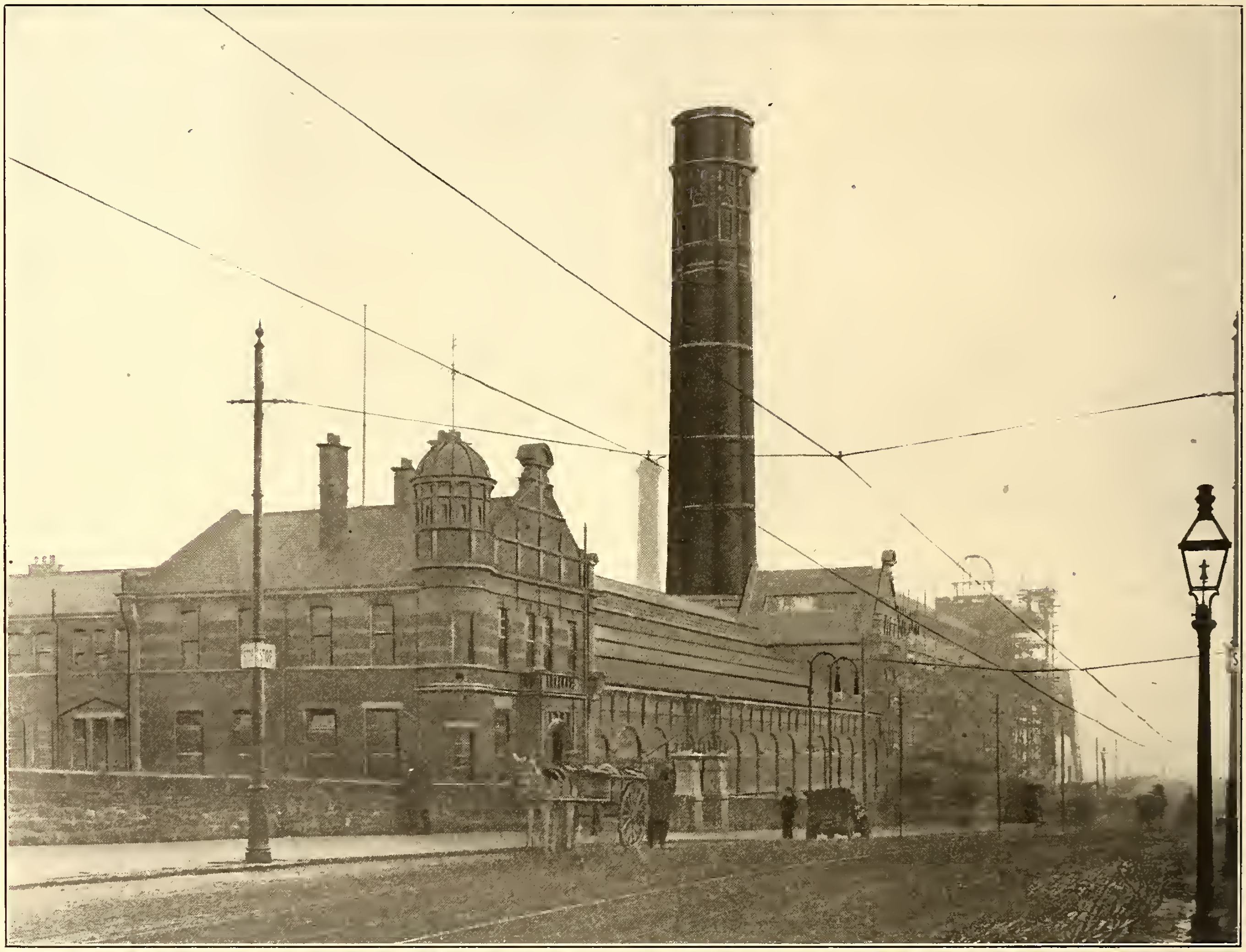
BOILERS AND AUXILIARIES

The layout of the boiler house is shown in the plan. Each boiler is provided with its own economizer immediately at the back, and this opens direct into the main flue. By this means the economizers receive the full heat value of the waste gases before cooling, due to radiation or leakage, can take place. Four Babcock & Wilcox water-tube boilers have been erected in the railway extension. Each boiler has a heating surface of 5764 sq. ft. and a grate area of 100 sq. ft., and is capable of evaporating from 20,000 lbs. to 25,000 lbs. of water per hour from and at 212 degs. F. Each boiler is fitted with a B. & W. patent superheater having 900 sq. ft. of heating surface, and capable of imparting a superheat of 150 degs. F. to the steam produced by the boiler. Each boiler is also provided with a double 5-ft. x 10-ft. chain grate stoker. The stokers are driven by a line shaft beneath the stoking floor, and connected by clutch gear to duplicate electric motors geared by means of worm reduction gear.

The economizers are of Green's make, 128 pipes to each boiler. The scraper gear of each economizer is also electrically driven through worm gearing.

An elaborate coal and ash-conveying system, installed by the manufacturers of the boilers, is in use.

The arrangement of steam pipe work is extremely simple, as can be seen in the plan. Each boiler, economizer and steam generator forms a unit, and is connected by means of an 8-in. steam pipe. A 10-in. main steam pipe in the boiler house simply acts as an equalizer between the various units. The pipes are of weldless mild steel, having a tensile strength of 24 lbs. to 27 lbs. per square inch, with an elongation of 20 per cent in a length of 6 ins. No cast-iron or copper pipes are employed.



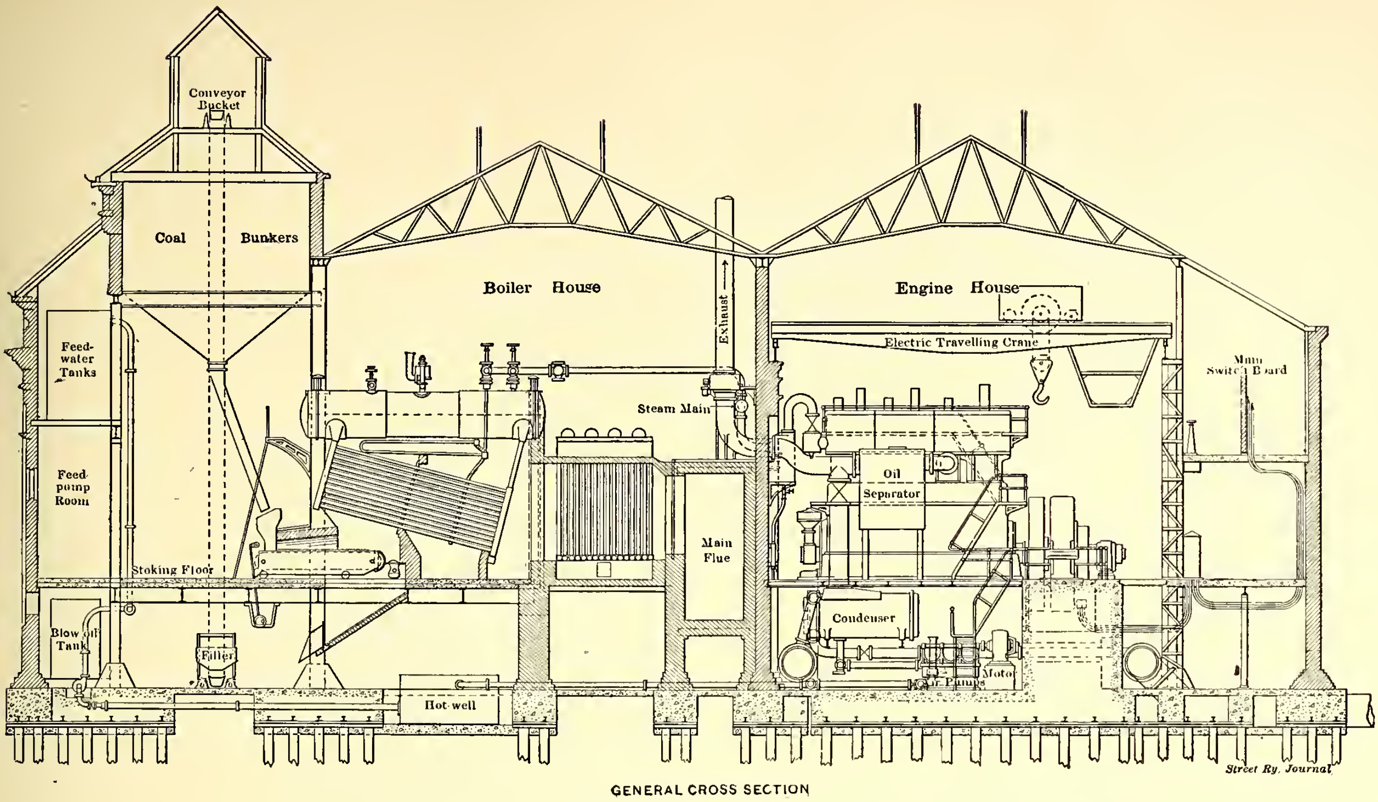
THE POWER STATION OF THE BELFAST TRAMWAYS

A duplicate system of boiler feed is provided throughout, and the supply is taken from the water mains. The feed-pumps consist of one compound vertical steam pump and two electrically-driven pumps, each capable of delivering to the boilers 8000 gals. of water per hour against the boiler pressure. The following are the guaranteed figures for the feed-pumps: Steam pump, 110 lbs. of water pumped per pound of steam; electric pumps, 3600 lbs. of water pumped per kw-hour.

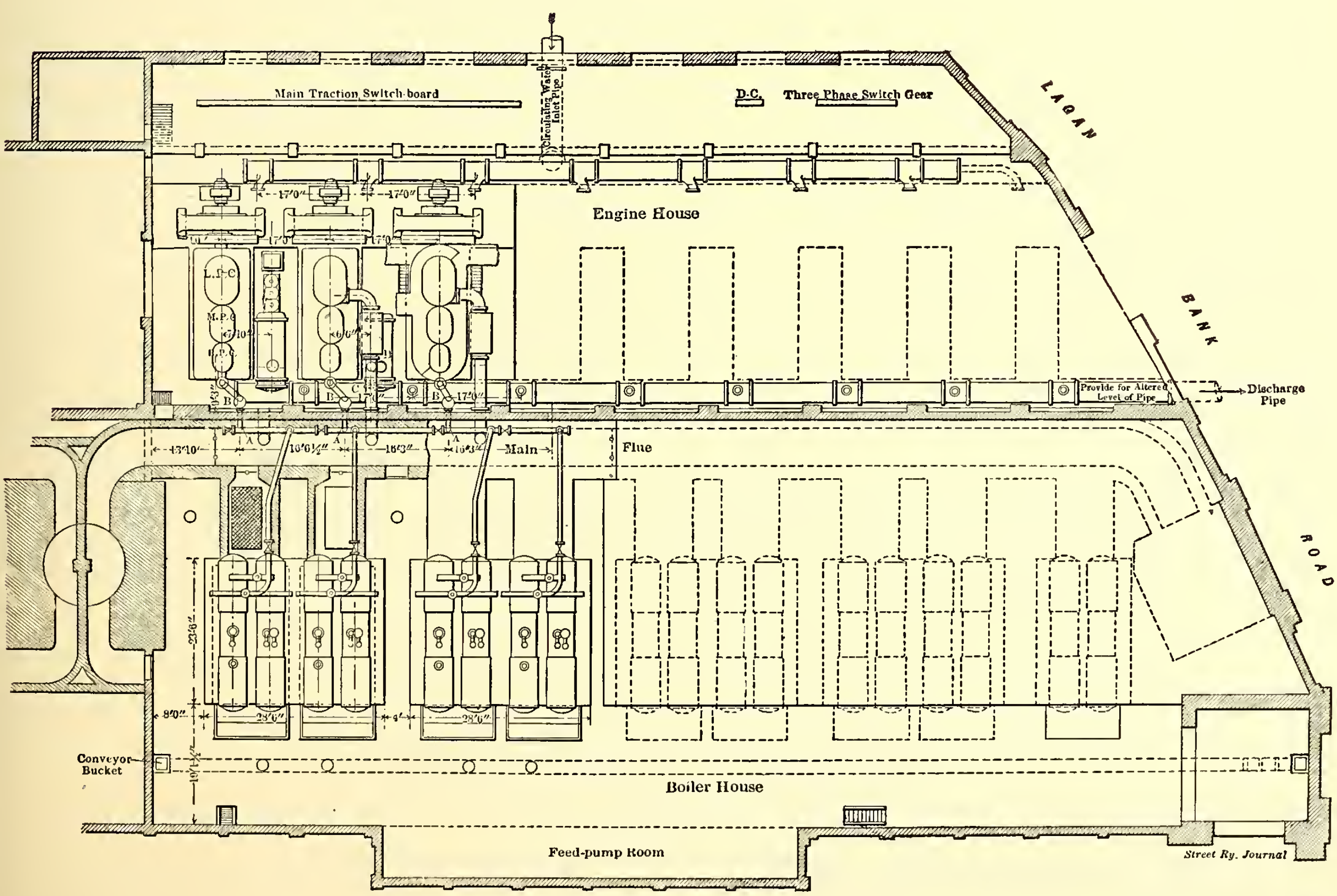
The valves employed throughout are of Hopkinson's make, for a working pressure of 200 lbs. per square inch, with outside screw spindles.

ENGINES AND GENERATORS

The generating plant erected in the railway extension consists of three 1000-kw d. c. engine units. The engines are of the vertical inverted, three-crank, triple-expansion, enclosed



GENERAL CROSS-SECTION OF EXTENSION OF BELFAST GENERATING STATION

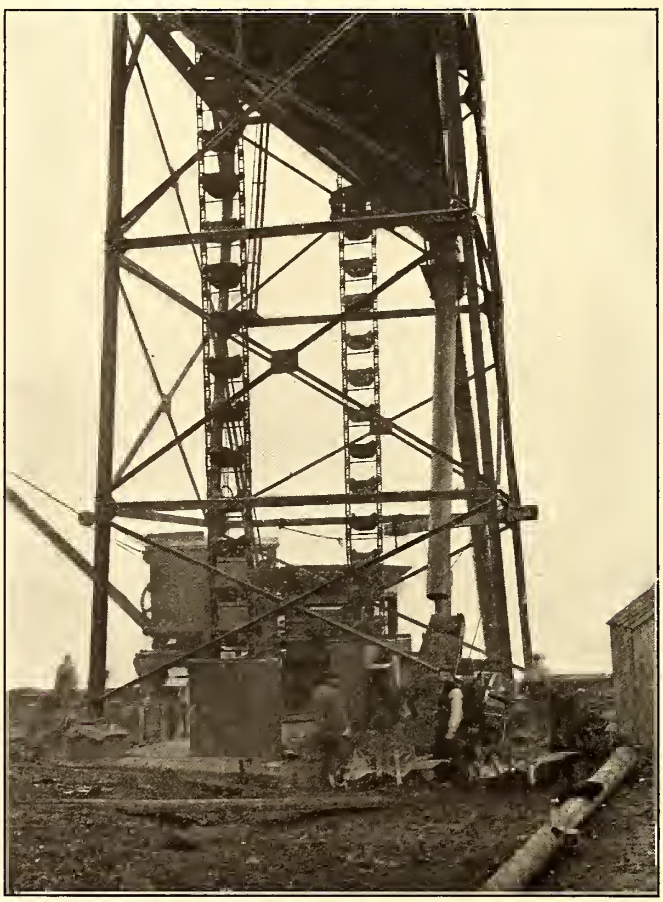


PLAN OF TRACTION EXTENSION OF BELFAST POWER STATION, SHOWING PRESENT AND FUTURE LAYOUT type, with forced lubrication, made by Combe Barbour, Ltd., of Belfast, and constructed to run at a speed of 180 r. p. m. with steam pressure of 170 lbs. per square inch and 150 degs. F. of superheat. The cylinder dimensions are 22 ins., 33 ins. and 50 ins. by 24-in. stroke. The steam consumption at full load condensing under the above conditions of steam pressure and temperature, and with 25 ins. of vacuum, is guaranteed at 16¾ lbs. per kw-hour, subject to additions or deductions of £250 per engine for every pound of steam per kw-hour below or above that figure.

CONDENSING PLANT

The condensing plant is of the counter-current surface type, with three-throw Edwards air pumps, manufactured by Mirrlees-Watson Company. The circulating water is obtained from the river by means of electrically-driven centrifugal pumps, arranged in a pump house on the river bank. Three Gwynne electrically-driven centrifugal pumps are at present erected, two 12-in. and one 15-in., and provision is made for the erection of two more when required.

Each main engine is provided in the basement with a separate condenser, having 2350 sq. ft. of cooling surface, and an electrically direct-driven three-throw Edwards air pump. The discharge from the air pump gravitates into a large cast-iron



ASH DISCHARGE ON WHARF

tank in the boiler house basement, and is lifted from thence to the hot well over the feed-pump house by means of electrically-driven centrifugal pumps.

An exhaust steam grease separator is placed between the engine and the condenser. Each engine is also provided with an atmospheric exhaust controlled by an automatic valve, which opens in the event of the vacuum failing, so that the sets can run non-condensing.

THREE-PHASE PLANT

Energy is transmitted at 6000 volts, three-phase, to a substation at the Fort William Depot for operating the portion of the system in that district, and for the supply of current to the Cavehill & Whitewell Tramway Company. This current is generated at 50 cycles by two 250-kw, three-phase, synchronous motor generators in the power station. The sub-station contains three similar equipments, except that they are of 125-kw capacity and that each is provided with a small three-phase induction starting motor mounted on the other end of the shaft. The efficiencies guaranteed for these machines are as follows, the efficiency being taken as the ratio of the d. c. input to the a. c. output:

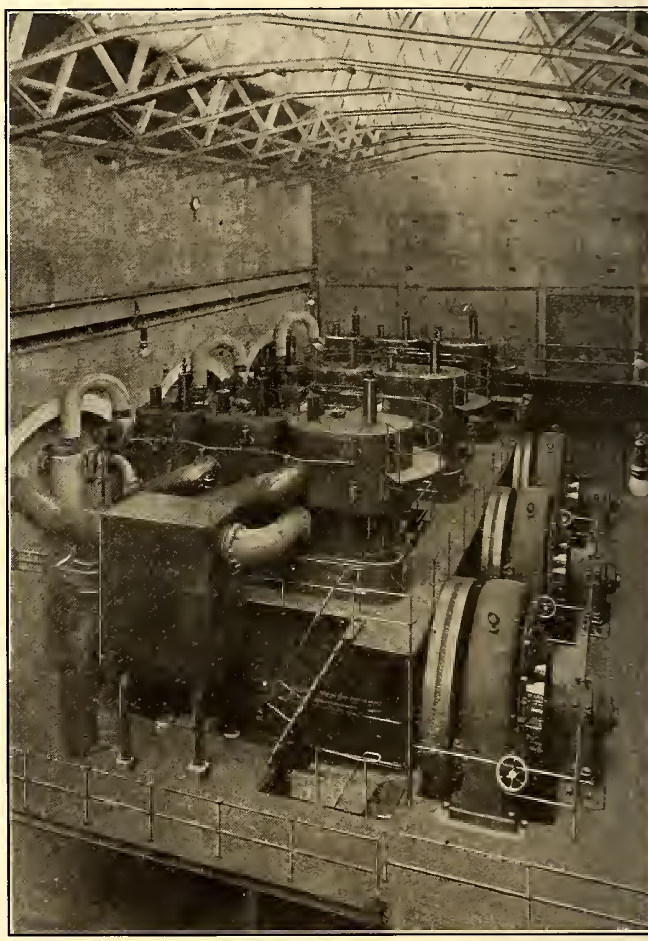
Load	250-kw Set Per Cent	125-kw Set Per Cent
1	87	83½
¾	86	82
½	82	78

The three-phase apparatus is of the Westinghouse make.

The sub-station is situated about 3 miles from the generating station, and is connected by means of a duplicate electric high-tension three-core trunk main, the section of each core being 0.075 sq. in. These cables are lead-covered and armored, and laid in earthenware troughs filled in solid with bitumen.

SWITCHBOARDS

The main traction switchboard and the three-phase operating switchboard are erected on a gallery which runs the full length



NEW ENGINE HOUSE IN THE BELFAST POWER STATION

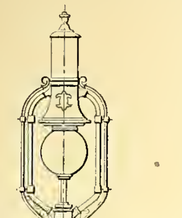
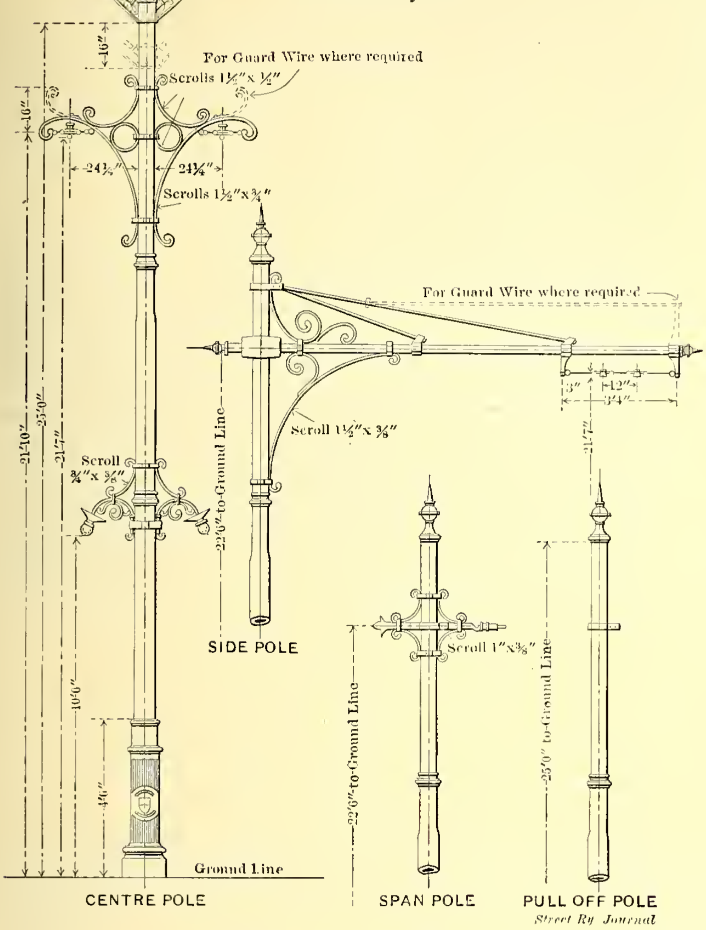
of the engine room at a height of 12 ft. above the main floor level. The main switchboard carries the usual apparatus, including a Board of Trade panel. All panels are of white Sicilian marble 2 ins. thick. The over all height is 92 ins., and the total length of the board is 50 ft. The Board of Trade panel is equipped with Elliott instruments.

OVERHEAD EQUIPMENT

The overhead equipment was installed by J. G. White & Company. The greater portion is of span wire construction, with the exception of 2½ miles of side bracket on outlying districts, and 2¾ miles of center pole construction in the wide main thoroughfares in the center of the city.

The poles are of lap-welded mild steel of the sectional type to the British standards specification. The pole fittings are of pressed steel, and all straps, bolts and nuts are galvanized. The poles are set at the usual distance of 40 yds. apart. The holes are filled in with 5 to 1 Portland cement concrete to a radial depth of not less than 8 ins. around the pole.

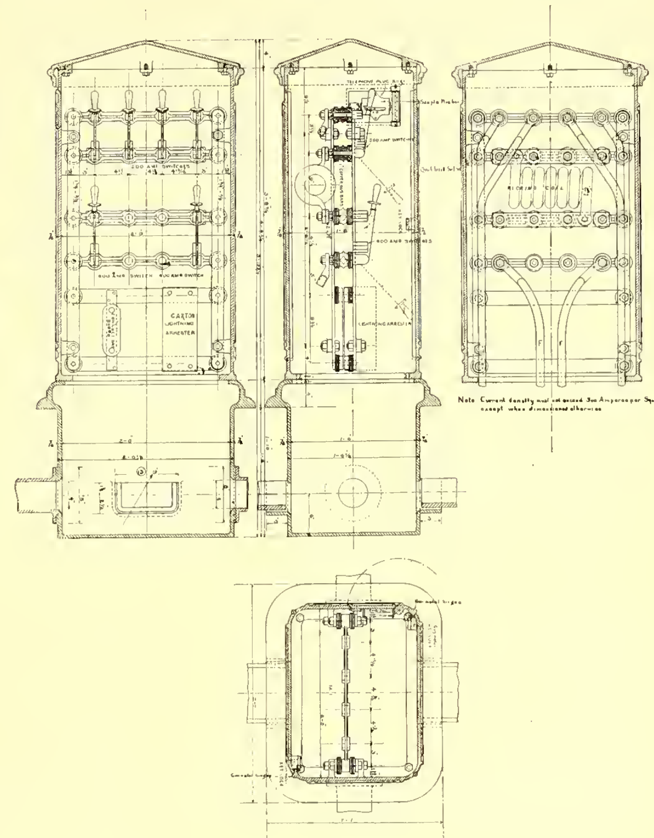
The trolley wire is of hard-drawn copper, 0.4 in. in diameter, with a breaking strain of 24 tons per square inch. It is double throughout, and is fixed at a height of 22 ft. above the track, flexible suspension being adopted in all cases. The trolley wire is arranged for center running on all span work, and the maximum deviation allowed in any case is 6 ft. from the center of the track. On curves, the wire in no case assumes an angle of less than 160 degs.

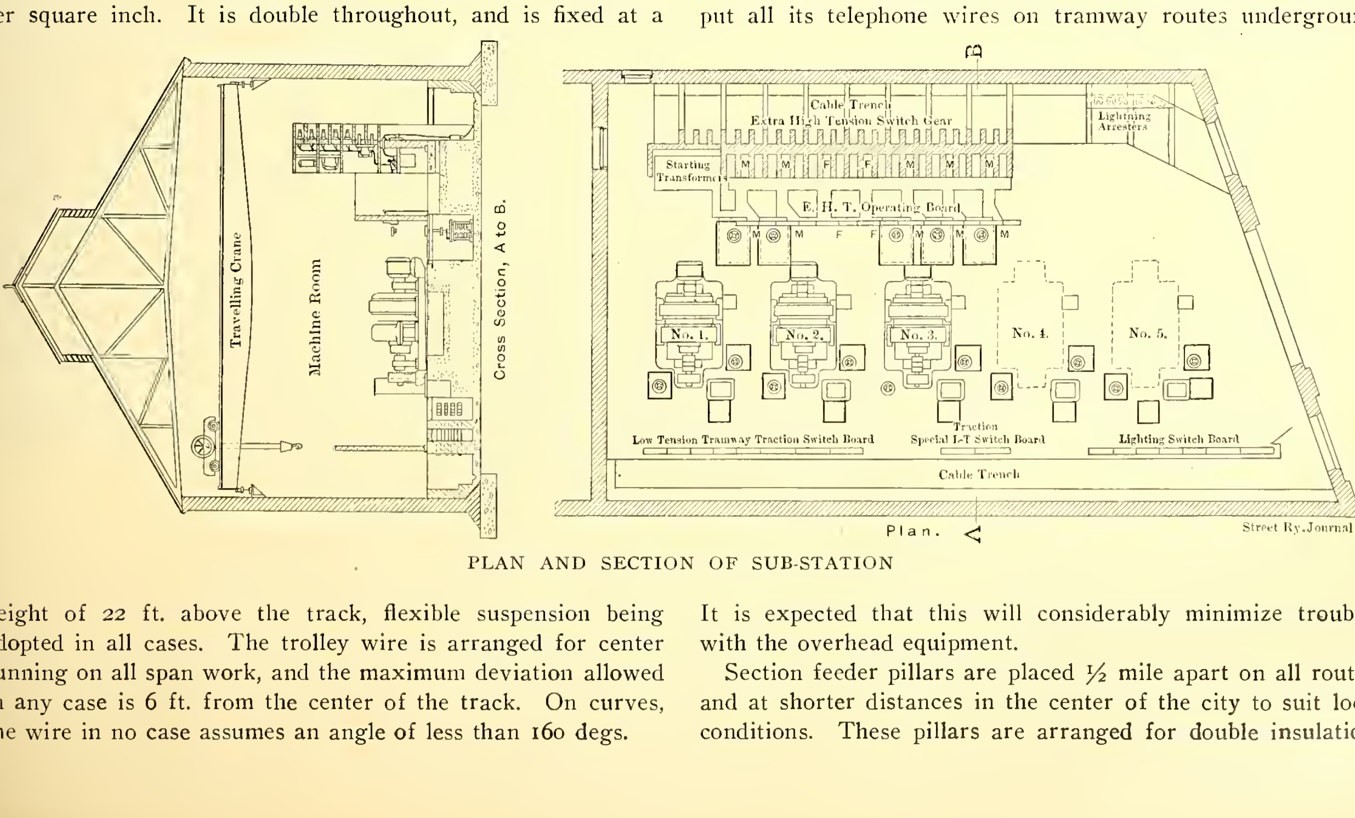
TYPES OF POLES ON THE BELFAST TRAMWAYS

Eighteen-inch ears are employed on the straight, and 30-in. and 33-in. ears on curves. The sectional insulators are of the straight under-running air-gap pattern, and are capable of standing a strain of 4000 lbs. The span wires are of 7/12's S. W. G. galvanized steel, with a breaking strain of not less than 4000 lbs. Duplicate insulation is employed throughout. The insulator bolts are ¾ in. in diameter, and both insulators and Brooklyn strains are capable of withstanding a strain of 6000 lbs.

The guard wires are of 7/16's S. W. G. galvanized steel, with a breaking strain of 2500 lbs. Guard wiring, however, has been reduced to a minimum, as the corporation, on the advice of Mr. McCowen, has required the telephone company to put all its telephone wires on tramway routes underground. It is expected that this will considerably minimize troubles with the overhead equipment.



SECTION AND FEEDER PILLAR



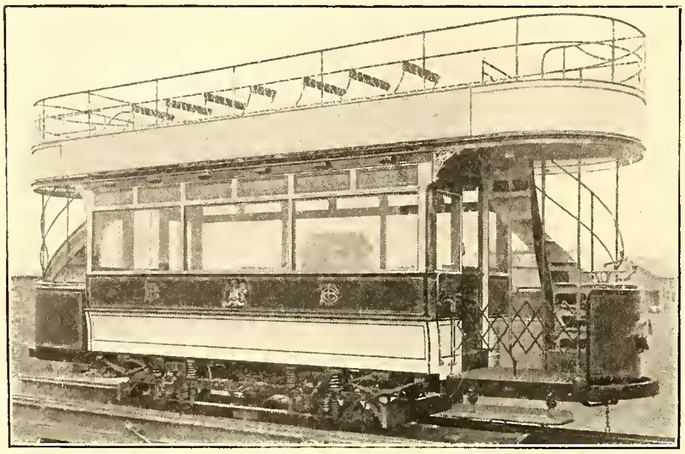
PLAN AND SECTION OF SUB-STATION

Section feeder pillars are placed ½ mile apart on all routes, and at shorter distances in the center of the city to suit local conditions. These pillars are arranged for double insulation, and each is provided with the following switching apparatus:

Two 400-amp. quick-break switches.
Four 200-amp. quick-break switches.
One bus-bar of 1 sq. in. section.
One lightning arrester and kicking coil.
One terminal board for telephone and test wire terminals, and
One telephone plug box.

The current density for all switches and connections is 500 amps. per square inch.

A small separate door is provided for getting to the telephone plug boxes, and owing to trouble from damp experienced with telephone instruments placed in pillars, the usual method has been departed from and plug boxes only are provided in the pillars. The instruments themselves are provided with an induction coil in the handle, and an instrument is taken on each car, which can be plugged on to any pillar, and communication made with the power house or car sheds as desired.



BELFAST STANDARD DOUBLE-DECK CAR

The center poles are lighted by means of two incandescent lamps fixed on each pole at a height of about 12 ft. from the ground. These lamps are simply for the purpose of indicating the position of the poles at night and not for street lighting, and are supplied from the lighting mains. Provision was made for erecting arc lamps on the center poles for street lighting, but this matter has been deferred for the present.

The overhead equipment in the six car sheds and over the approaches has been carried out by Mr. McCowen's own staff. Mechanical ears have been employed throughout this work, which has resulted in a considerable saving in cost and gives excellent running. In some of the larger sheds one trolley wire is arranged to serve two lines of track. This method has been adopted with a view to reducing complications in the overhead special work, and, as in one case, as many as seventeen tracks are taken off the two approach tracks, and in another twenty tracks are taken off a single track, the possible complications of overhead equipment can be imagined.

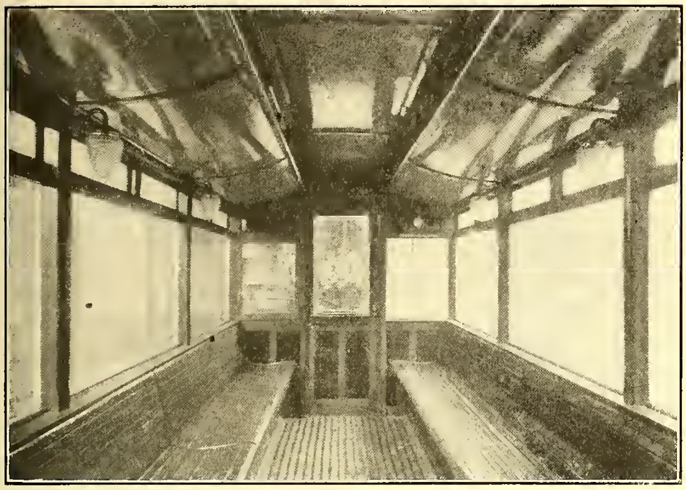
MOTOR TOWER WAGON USED IN BELFAST

INTERIOR VIEW OF THE BELFAST TRAMWAYS CAR HOUSE AT FALLS ROAD

The overhead wiring of each shed is separated from the street wiring by sectional insulators, and the supply of energy to each shed is controlled by a circuit breaker and wattmeter, so that the energy used in the sheds can be carefully watched and the outside lines protected from interruptions due to faults in the car sheds. The approaches to each shed are brilliantly lighted by means of arc lamps supplied from the lighting mains where these are available, and in the other case from the tramway supply.

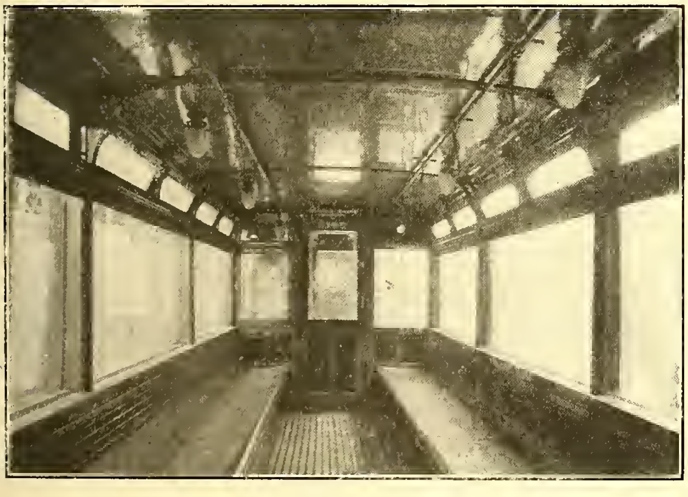
CABLES

All of the cables required were manufactured and laid by Callender's Cable & Construction Company, Ltd., of London and Erith. The total trench work required amounted to 65,000 yds., or 57 miles, of route, and the total amount of cable amounted to 93 miles. The weight of copper used was more than 250 tons.



INTERIOR OF CONVERTED BELFAST HORSE CAR, SHOWING LIGHTING SYSTEM

The tramway feeders are all single conductor vulcanized bitumen cables, and are made up of a strand of soft copper wire, with a conductivity of not less than 100 per cent of Mathiessen's standard. The cables were subjected at the works to a pressure test of 2500 volts alternating. The pilot cables for the tramway feeders are three-core, 7/20, paper, vulcanized bitumen insulated. The rail return cables and the Board of Trade pilot wire from the four Board of Trade pillars were also made in accordance with the above specification.



INTERIOR OF STANDARD BELFAST CAR

In addition to these cables, a three-phase high-tension main was laid in duplicate from the generating station to Fort William Depot. These cables were three-core, paper, lead-sheathed and single-wire armored, suitable for a working pressure of 6000 volts, with the center point of the star winding unearthed. These high-tension cables were subjected at the works to a test of 12,000 volts alternating.

All the cables were laid on the "solid system" on specially designed porcelain bridges in earthenware troughing.

At four points on the route, where the return feeder cables were connected to the track, four pillars, designed and manufactured by Messrs. Callender, were erected and coupled up complete in accordance with the requirements of the Board of Trade. Each pillar contains:

One bus-bar having a sectional area of 2.5 sq. ins., with disconnecting lugs for connecting the four cables to the rails and two return feeder cables.

One double-pole throw-over switch for 100 amps.

One maximum-demand indicator, capable of carrying 75 amps. in one of the pillars and 80 in the other three.

One circular pattern ammeter reading from .05 to 5 amps.

One 3-cell Laclanche battery in box.

Along the various routes there are placed seventy-six feeder pillars and eight section pillars, into which the feeder and telephone cables were looped at distances of approximately ½ mile. These were of British Electric Equipment Company's make. The connection between the feeder and section pillars and the overhead trolley wire has been made by means of single-conductor, rubber, lead-sheathed cables of 5000-megohm grade.

CARS AND TRUCKS

The number of cars ordered was 170, and for this part of the contract the corporation selected the tender of the Brush Electrical Engineering Company, of Loughborough. The cars are of uniform type and capacity, and may be accepted as typical of the British single-truck, double-deck car. The over all dimensions are 28 ft. in length, 6 ft. 10 ins. in width and 13 ft. 2½ ins. in height. The length of each platform is 5 ft. 6 ins., and there is a clear height inside at the center of 6 ft. 9 ins. The passenger capacity is twenty-two inside and thirty-two outside. The weight of the car without passengers, but including electrical equipment, is about 20,000 lbs. The cost was £586 per car. Especial features which attract attention in these cars are the systems for ventilation and lighting. As shown in the side view of the car, ventilation is secured through six wing scoops on the letter board, which point forward, and six which point backward. The lamp for lighting the interiors in both the new and converted cars are enclosed in ornamental globes.

The electrical equipment was supplied by the British Westinghouse Electric & Manufacturing Company, and consists of the No. 200 motors with 90-M series-parallel controller.

The cars are mounted on Brush trucks of the standard type, with a wheel base of 6 ft. 6 ins. Steel-tired wheels are used, and the trucks are fitted with Hudson-Bowring life-guards.

OFFICERS

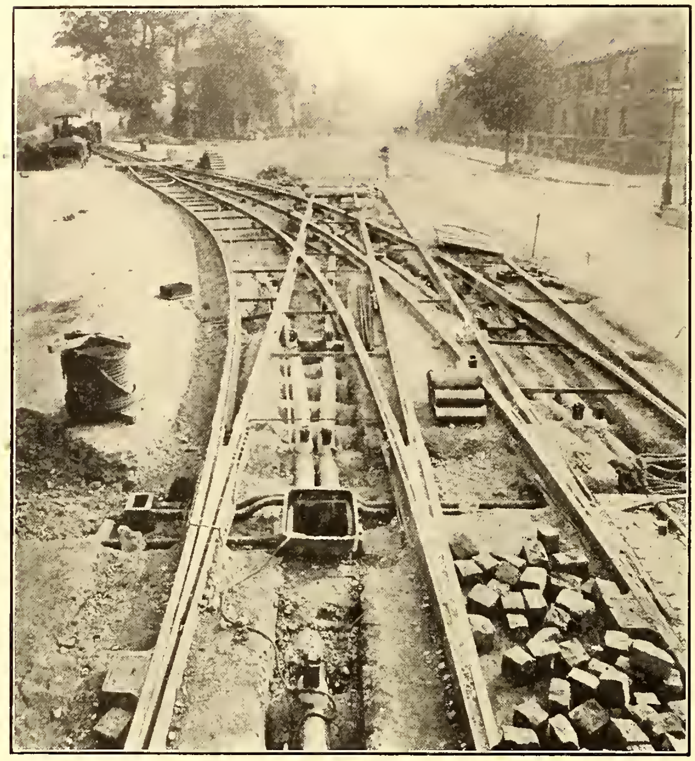
This paper is indebted to H. A. Cutler, city engineer; V. A. H. McCowen, city electrician, and Andrew Nance, general manager of the tramways, for courtesies extended in the preparation of this article.

NEGOTIATIONS PENDING FOR RAILWAY BETWEEN BUFFALO, LOCKPORT AND ROCHESTER

The Niagara Falls Electrical Transmission Company is said to be negotiating for the purchase of the Buffalo, Lockport & Rochester Railway Company, together with all the right and title to the railway company's right of way from Rochester to Lockport. The railway company, which is capitalized at $2,000,000, is building an electric railway to connect Rochester and Lockport. The right of way, which is of itself a very valuable thing for the transmission company to own at this time, has been secured for the entire distance, but the construction has progressed in part only to a point between Spencerport and Adams Basin. At no point on the line, except in the village of Albion, have any rails been laid. It is understood that the purchase, if made, will not be by the transmission company direct, but by persons as individuals who are large stockholders in the transmission company.

SURFACE CONTACT SYSTEM IN LINCOLN

The popularity of surface contact systems in England is evidenced by the equipment of the lines of the Municipal Tramways Company, of Lincoln, with the system of the G. B. Sur-



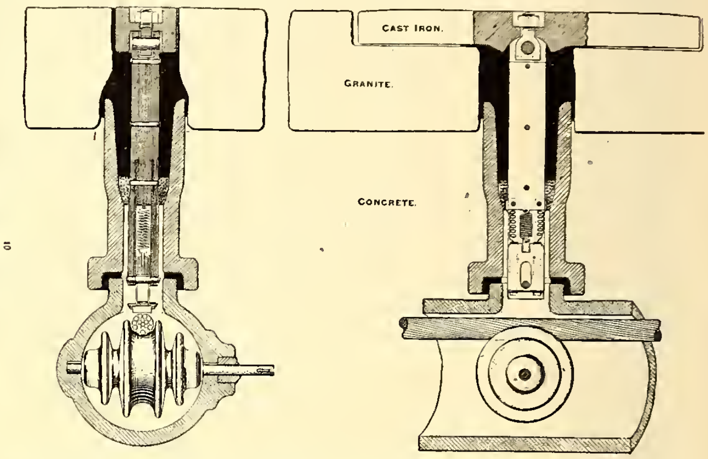
A JUNCTION ON THE LINCOLN CONDUIT SYSTEM

face Contact Company, of London. Lincoln is one of the old cathedral towns of England and has a population of about 50,000 inhabitants. Horses were used as a motive power until about two months ago, when the first section of electrified line,

CONDITION OF TRACK WHEN PAVING

consisting of 1¼ miles of double track and ½ mile of single track, was put in operation.

The G. B. surface contact system had previously been in experimental use on a short section of line in London, but this is the first commercial installation. The current is supplied from a galvanized iron cable, which is carried in a conduit with an inside diameter of 5 ins., under the center of the track. There are connections to the surface every 9 ft. by which the current is conducted to stud heads laid flush in the pavement. The cable is supported in the conduit, as shown in the section, on a corrugated round insulator, whose shaft extends on one side through the side of the conduit, and is there earthed to prevent any leakage to the contact stud when the latter is supposed to be dead. All longitudinal and vertical joints in the conduit are sealed with bitumen to prevent the entrance of any water. The stud is electrically connected with the cable, when the car passes over it, by means of a plunger which is held by a spring normally away from the iron cable. When the magnets on the car pass over the stud plate, the plunger is magnetically



CROSS-SECTION OF CONDUIT THROUGH CENTER OF STUD, SHOWING SWITCH PIECE DOWN, AND LONGITUDINAL SECTION OF CONDUIT THROUGH CENTER OF STUD, SHOWING SWITCH PIECE UP

drawn down to the cable and current is led to the plate. After the car has passed the stud plate, the plunger is drawn back out of contact by its spring.

The skate, or collecting device, on the car consists of a chain

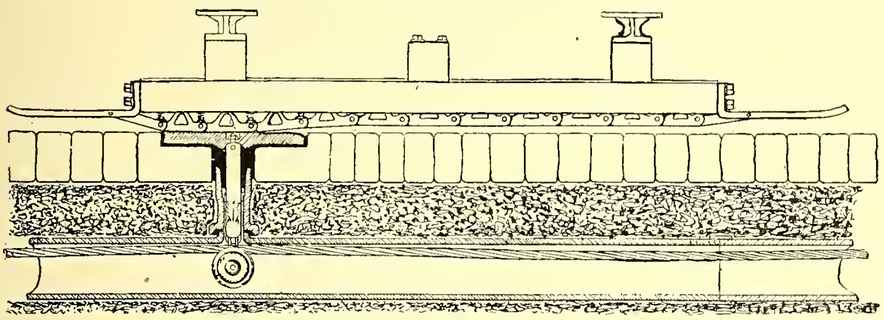
COMPLETED CONDUIT BEFORE FILLING WITH CONCRETE

of triangular iron links, as shown in the side view. These links are connected at each end with the electromagnets carried on the car, and when the car passes over a stud head the links move down and make contact with it. After passing a stud, the links are drawn up out of contact with the pavement by springs. A storage battery of nine cells is used on the car to excite the magnets in case of temporary failure of the source of current supply and in starting the car. The batteries are connected in parallel with the magnets and in series with the motors. It is stated that cars have been run at a speed of 20 m.p.h.

The accompanying views show the details of the system as well as portions of the Lincoln Tramways while under construction. The diameter of the galvanized wire cable in the conduit at Lincoln is 1¼ ins., and the average leakage on the 3 miles of line now in operation is said to be .3 amp. at 500 volts. The Lincoln system has eight double-deck cars equipped with Westinghouse motors and mounted on Brush trucks.

REPORT ON AMERICAN RAILWAYS BY A LONDON OFFICER

A. L. C. Fell, chief officer of the London County Council Tramways, who made a trip to this country during the spring of 1905, has just rendered his report to the County Council. Mr. Fell visited New York, Washington, Pittsburg, Toronto, Buffalo, Boston, Albany and Schenectady. In his general remarks he states that he was greatly impressed with the high-speed interurban electric lines in this country, but also with the poor condition of the street paving in some of the cities visited. This point he thinks should be taken into consideration when comparing the operating conditions with those of similar undertakings in London. In New York and Washington he was very much interested in the conduit system used, but considered that the method of changing from plows to trolley, in Washington, is less convenient than that employed in London and Paris. He noticed single-ended cars in Toronto for the first time, and thought well of the Toronto momentum brake (see the issue of this paper for June 13, 1903), which he proposes testing in London. He also approved of the convertible cars which are used in that city (see the issue for March 12, 1904), but doubted whether the same convertible principle was applicable in London, where the cars are narrower and where only four passengers can sit on a cross seat instead of five as in Toronto. In Pittsburg and Schenectady he inspected the single-phase system. He considers the American system of fare collection and registration crude, but states that in Boston the Railroad Commissioners are now considering the adoption of the ticket system as employed in London. Other features of American practice which he looked upon with favor were schools and recreation rooms for employees and repair shop design.



LONGITUDINAL SECTION OF ROADBED AT LINCOLN, ENGLAND, SHOWING POSITION OF CABLES, CONTACT STUDS, ETC.

Mr. Fell also devotes considerable attention to the subject of rail corrugations, referring to the corrugations on the Boston elevated system, on which corrugations no less than 31 ins. in length and .015 ft. between the top and the bottom of the wave were found. In all other cities visited except Buffalo, corrugations were found in a more or less marked degree, and apparently the length of the corrugation wave increased with the average speed of the cars. He said that the British electric roads also show corrugations varying in length from 2½ ins. to 5 ins., and that the worst corrugations appear at curves, where a short wave is formed on the outer rail and a longer wave on the inner rail. The corrugation at first appears on the outer rail. Similar trouble has been experienced on the Brixton cable road in London, except that the corrugation at the curve started on the inner rail and was transmitted to the outer rail, and that the longer corrugation is on the outer rail and not on the inner. No corrugation has been noticed on horse railways or on steam railways, but it has appeared on steam-driven tramways in England. He states it as his opinion that the unevenness may be due to three causes: (1) Chattering or vibration of the rollers when commencing to roll the ingot into a rail, causing a rough rail surface. (2) Uneven or wide joints between rail ends, rigidly supported on a concrete bed. (3) Jumping action set up in car wheels by variations on the wheel or track gage.

To ascertain if his first theory was correct, Mr. Fell made some tests in the New Cross car shed before the rails had been used in any way by the cars. A long emery block, fitted under a truck, was run lightly over several lengths of track, and a distinct corrugation was noticeable on the rail surface, although in some instances it was not very regular in form. About nine months ago he had a water tank fitted up with a grinding apparatus, consisting of a carborundum block, 10 ins. long x 2½ ins. wide, which could be pressed down on to the running rails. By this means some of the worst corrugations were ground out, and have not yet reappeared. He says that now the corrugation of the rails is becoming somewhat serious on all the sections of the London system, but additional grinding apparatus is being fitted on the new water tank cars, which will shortly be delivered, and he hopes to be able to grind out the waves. Mr. Fell found that no attempt has been made hitherto in America to get rid of the trouble in the manner suggested.

To obviate the trouble, Mr. Fell suggests that with new rails arrangements should be made, if possible, for passing them through a grinding machine after rolling; the corrugations are so slight that very little would have to be done to prevent the trouble developing in a serious manner at a later date.

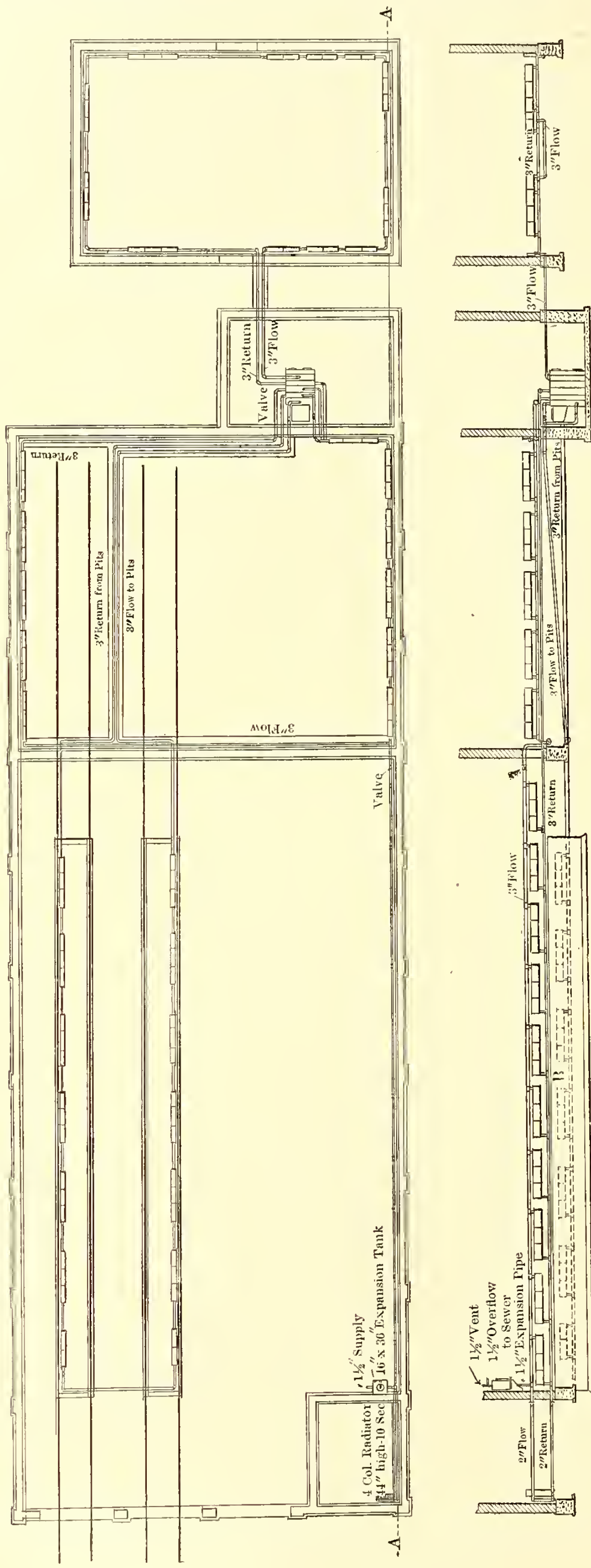
A COURSE IN ELECTRICITY ON THE SOUTH CHICAGO CITY RAILWAY

General Manager George R. Folds, of the South Chicago City Railway, has organized a class composed of employees of the road for the study of electricity. The course is not intended to deal with the operation of cars and other electrical apparatus, but is designed to teach the elementary principles of electricity to all the employees, whether or not they are employed with electrical apparatus. The benefit the company will derive, if any, from the inauguration of the course will be that resulting from the closer feeling of fellowship which will be built up between the employees themselves and between the employees and the officers by meeting together.

After the course is well advanced, if desired by the employees, special study will be made of street railway electrical equipment, such as controllers, motors and power house apparatus. Different officers of the company serve as instructors. Among the teachers is E. Jowett, chief engineer of the power station. Mr. Folds is well fitted for the task undertaken, as he organized a course of instruction for the Brooklyn Rapid Transit Company when with that company.

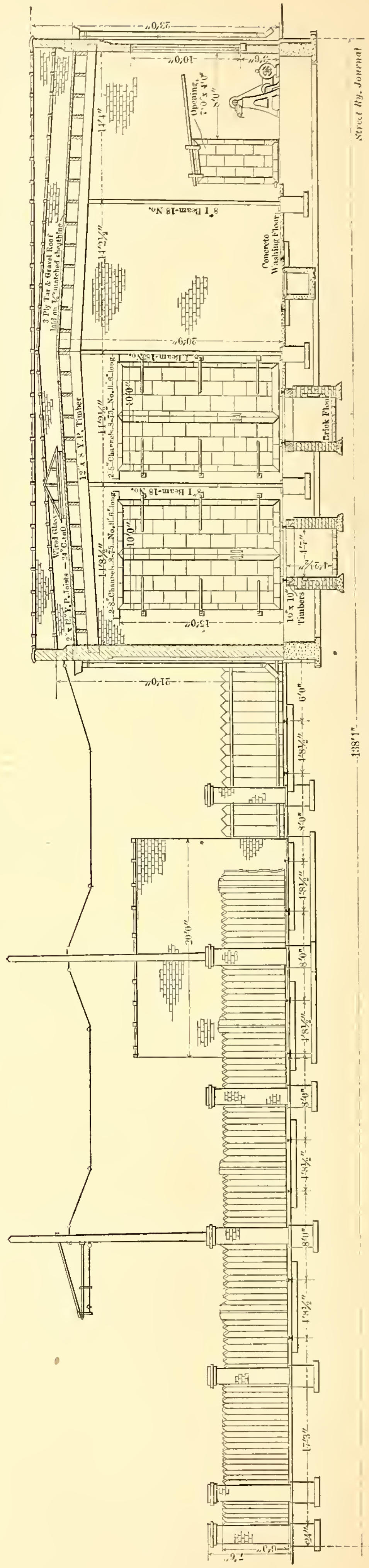
THE NEW CAR REPAIR SHOPS AT FORT SMITH, ARK.

The street railway system of Fort Smith, Ark., has undergone a complete reconstruction since it was acquired by H. M. Byllesby & Company, of Chicago, a little more than a year ago. The power house has been rebuilt and enlarged, the lines

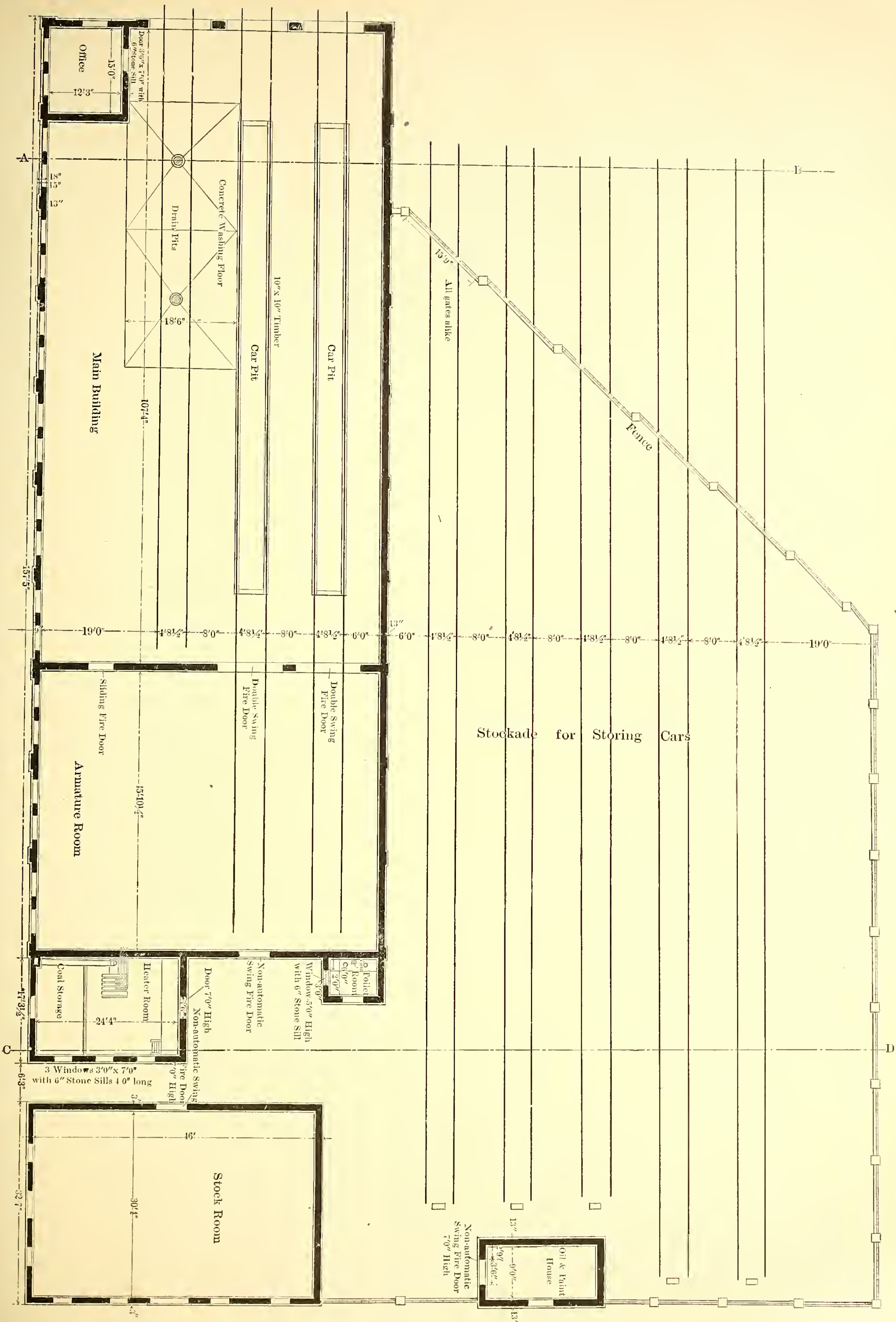


HEATING SYSTEM FOR FORT SMITH CAR HOUSE

extended, a pleasure park containing more than 100 acres opened up and other improvements tending to put the system on a well-paying basis have been inaugurated. Of the new features, the shops recently erected to care for the equipment



SECTIONAL ELEVATION THROUGH FRONT OF NEW CAR HOUSE AT FORT SMITH, ARK., SHOWING REPAIR SHOP AND STORAGE STOCKADE



PLAN OF CAR HOUSE AND STORAGE STOCKADE AT FORT SMITH contains many interesting features. They are not, to be sure, as completely equipped as shops for larger systems, yet they are deserving of a description of some length because of the fact that in their design all the requirements of shops for a small system were considered and well worked out.

One of the main points kept in mind in the design of the shops was that they should be as nearly fireproof as possible with a reasonable outlay of money. A special point was made of reducing the risk of losing cars by fire and also of reducing the cost of insurance on cars, and to this end no provision was made for storing cars indoors. A stockade built along one side of the shops serves as a storage yard. In addition to the main shops, there has been erected in the immediate vicinity a storeroom and an oil house.

The main repair shop is a brick structure measuring 175 ft. 5 ins. x 58 ft. 4½ ins. The foundations, which are of concrete, rest on a bed of hard-packed sand.

The roof is of slow-burning mill construction, being supported through the middle of the building by 8-in. I-beams extending from the floor. Yellow pine timbers, 8 ins. x 12 ins., support a joist measuring 2 ins. x 12 ins. and placed with centers 24 ins. apart. These joists, in turn, carry ⅞-in. tongued and grooved sheathing covered with 3-ply tar and gravel roofing. As a further protection against fire, the wall of the building alongside the stockade is a fire wall, being without windows. To properly light this side of the building, on this account it was necessary to place skylights in the roof. These are of ample dimensions and are glazed with wire factory glass.

The interior of the building is divided into two sections by a fire wall. The wall extends up above the roof of the building, the openings through it being provided with automatic fire doors.

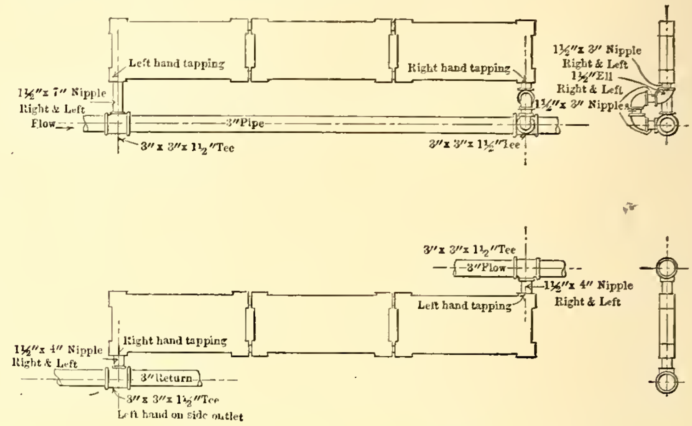
The rear portion is used as a paint shop and winding room, while the larger of the two rooms serves as a general repair shop. In addition to two repair tracks, which extend the full length of the building, this room contains a track devoted entirely to the washing of cars. The concrete floor under this section slopes to two sinks which are provided with drains. Under each of the repair tracks pits are provided, the brick walls of which rest on concrete foundations. The walls support 10-in. x 10-in. stringers, and upon these the rails are spiked.

The shop is well supplied with machine tools. These are all located along that wall of the building opposite the storage yard, the list including a hydraulic wheel press, boring mill, lathe, drill press, emery grinder and other minor tools, all driven through a countershaft by one motor.

An ideal sectional water-tube boiler located in a small attached brick structure in the rear of the shops, supplies the necessary heat to the building. Radiating sections are used instead of the usual pipes for heating the main portion of the shops. These are located along the walls under the windows. The pits are heated by an independent circuit, thereby permitting the heat to be turned on or off the pits independently. It is thought heater pipes as usually installed in car-house pits are objectionable, because the pipes are so exposed that they are frequently torn down or caused to leak by heavy repair parts falling on them from above. One of the accompanying drawings shows the method of installing the radiating sections in the pits, the recesses in the pit walls shielding the sections from injury. These sections were also used in preference to the usual piping because of the lessened total expense.

The storeroom located in the rear of the shop is somewhat larger than would be required for street railway supplies alone, and it will be used for electric light and power house supplies as well. The oil storage house is a brick structure located some distance from the main shop. Ventilators are built into the walls of the building, as may be observed by reference to one of the drawings.

The yard in which the cars are stored is surrounded by a stockade. At intervals of about 12 ft. brick posts, 18 ins. square, are built, and these relieve the otherwise monotonous appearance. The stockade contains four tracks. The trolley wires over four of these are supported by spans between two



DETAIL OF RADIATOR CONNECTIONS FOR HEATING SYSTEM AT FORT SMITH CAR HOUSE

lines of poles. The wire over the fifth track is carried on spans attached at one end to one line of poles, and at the other to brackets on the side of the building. The peculiar shape of the stockade was rendered necessary because of the proximity of the street in front, which runs diagonally with respect to the general direction of the walls of the shop.

Two fire hydrants are located at convenient points within the enclosure. These, as well as those within the building, will be connected to the city water system.

Passing immediately in front of the shops is the double-track line of the system leading to the ball park and to Electric Park, an amusement resort located on the Arkansas River. In order to prevent interference with cars on the main line, all the tracks from the shop and storage stockade lead to a set of double tracks running parallel with the main tracks, and these in turn lead to the main tracks.

When set in the yards, the cars are placed 10 ft. apart. Heavy tarpaulins are provided, and during inclement weather the cars will be covered. The tarpaulins used are of sufficient size to cover a 25-ft. or 30-ft. car, and cost $65 apiece.

O. E. Osthoff, vice-president of the firm of H. M. Byllesby & Company, under whose direction the shops were designed, states that the total cost of the plant was approximately $18,000.

CURIOUS ACCIDENT IN COLUMBUS

On Jan. 6 a car of the Columbus Railway & Light Company, of Columbus, Ohio, eastbound on West Broad Street, was stopped by a work car ahead, bound in the same direction, which had blown a fuse. A passenger, James Nusbaum (an ex-employee of the company), became impatient at the delay, went to the forward doors leading into the vestibule, and remonstrated with the motorman. The motorman politely requested Nusbaum to step inside the car, which he did, and the motorman closed the doors. Nusbaum resented this action by pulling the doors open again and berating the motorman, who shut the doors on Nusbaum's nose. Not being satisfied with the information he received when he called at the office of the company, Nusbaum had a warrant issued for the motorman's arrest on a charge of assault and battery. At the trial it was shown that the motorman had no intention of assaulting him, and in fact did not assault him, and the case was dismissed. B. B. Davis, claim adjuster for the company, says he never heard of a case of this kind before.

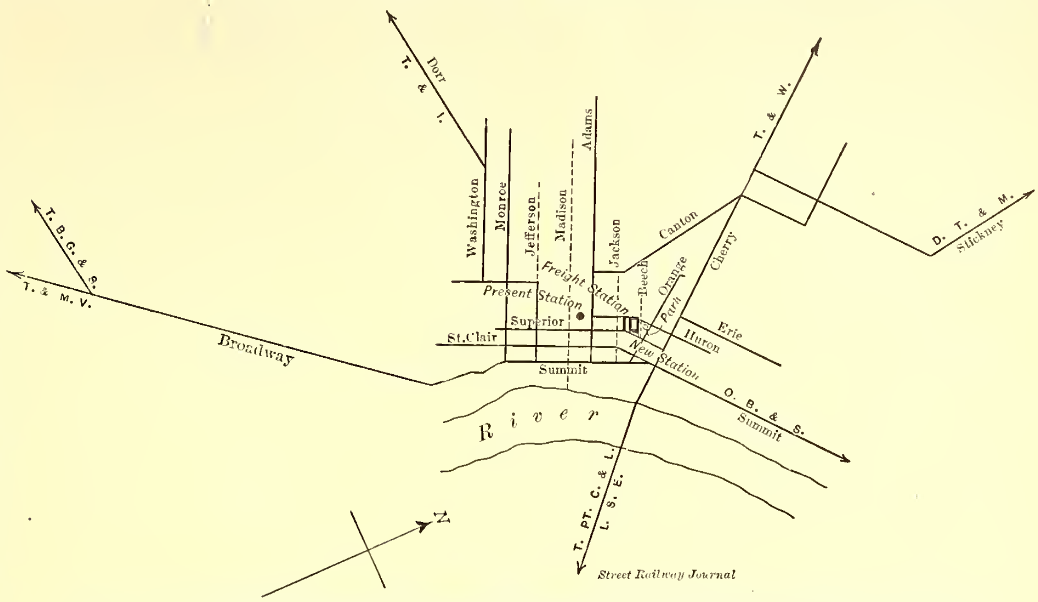
NEW UNION STATION FOR TOLEDO

Work has been started on the new interurban union station at Toledo. The building will be owned and operated by the Toledo Railways & Light Company, and will be utilized by the seven roads entering that city. It will be located at Beech, Huron and Superior Streets, with a frontage on the first-named street of 342 ft., 125 ft. on Huron Street and 125 ft. on Superior Street. Following the plan adopted for Indianapolis, it will include an office building, with a separate train shed. It will be a flexible layout, as the ground space owned by the company provides room for another train shed of the same size, while the office building portion, at present designed to be three stories high, will have walls of sufficient strength to support three additional stories.

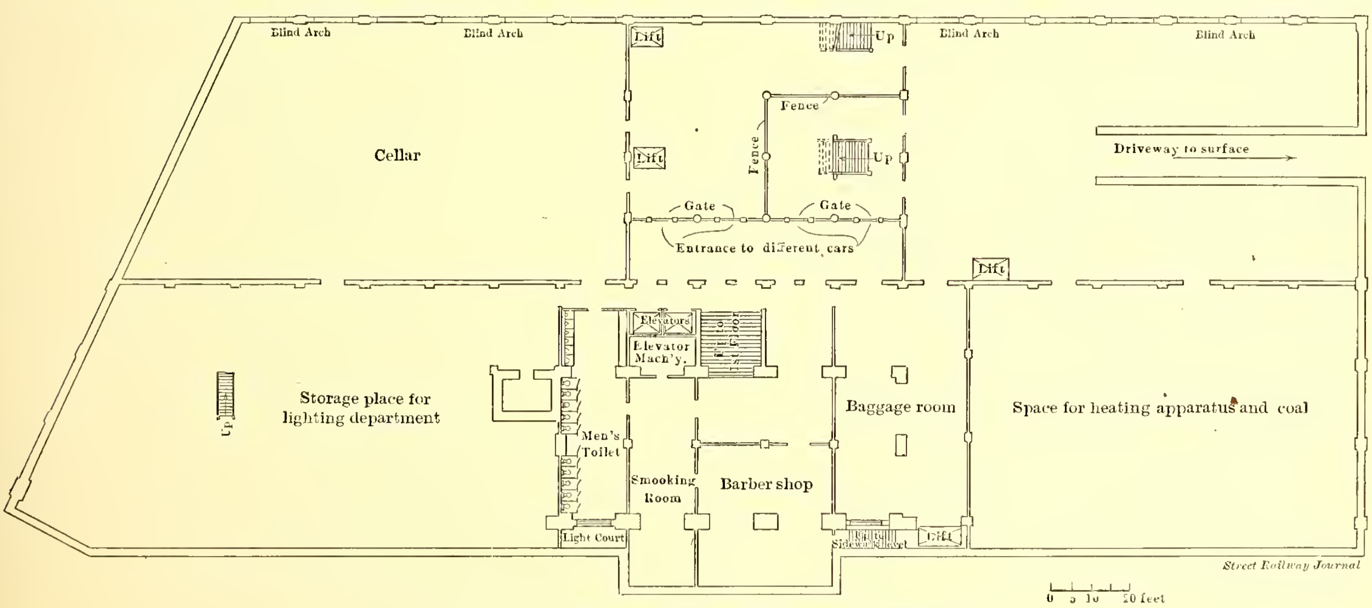
The building will be of fireproof construction, with steel frame work and brick and porous fireproofing. It will face a small public park, and the front will be of ornamental design. A 16-ft. arcade will run through the center of the building from Huron to Superior Streets, parallel to the tracks, providing entrance from these streets, while the main entrance will be on Beach Street through three large double doors opening into the main waiting room, 50 ft. x 85 ft. This room will be two stories high. Adjoining this on either side will be check and lunch rooms, a news stand, ticket office and ladies' rest room. The Beech Street front will contain eleven stores, and one corner of the building and half of the basement will be utilized by the company for its lighting department. The company's general offices will be above. In the basement beneath the waiting room will be a men's smoking room, toilet rooms, barber shop and a large baggage room. An incline roadway will reach the baggage room and large basement from the Huron Street side. Trunks and baggage will be elevated to the tracks or to the sidewalks on the Beech Street front by lifts, so that all loading and unloading of baggage in the station proper will be eliminated.

There will be four tracks in the train shed, each 340 ft. long. One of the most interesting features of the station will be an arrangement that will avoid the crossing of the tracks in the train shed by passengers. Cars will enter from either Huron or Superior Streets, both of which have double tracks. Cars for tracks Nos. 1 and 3 will enter from the Superior Street side, while those for Nos. 2 and 4 will enter from Huron Street. Between tracks 1 and 2 and between 3 and 4 will be a narrow devil's strip just wide enough for the cars to pass, while the space between 3 and 4 will be the same width. Between these tracks will be railings extending the full length of the building. The Toledo cars are nearly all single enders, and load and empty from one side. Passengers for track No. 1 will enter directly from the station floor, but those for Nos. 2 and 3 will pass down a flight of stairs, through a passage under the tracks, and up to a wide platform. Passengers for track No. 4 will pass beyond to a similar stairway and to a platform beyond No. 4 track. The various roads will always use the same track, and announcers will designate the proper track. There will be no posts in the station, eliminating another prolific source of accidents. As intimated, the trackage space and train shed can be increased 100 per cent without changing the plan of operation in the least.

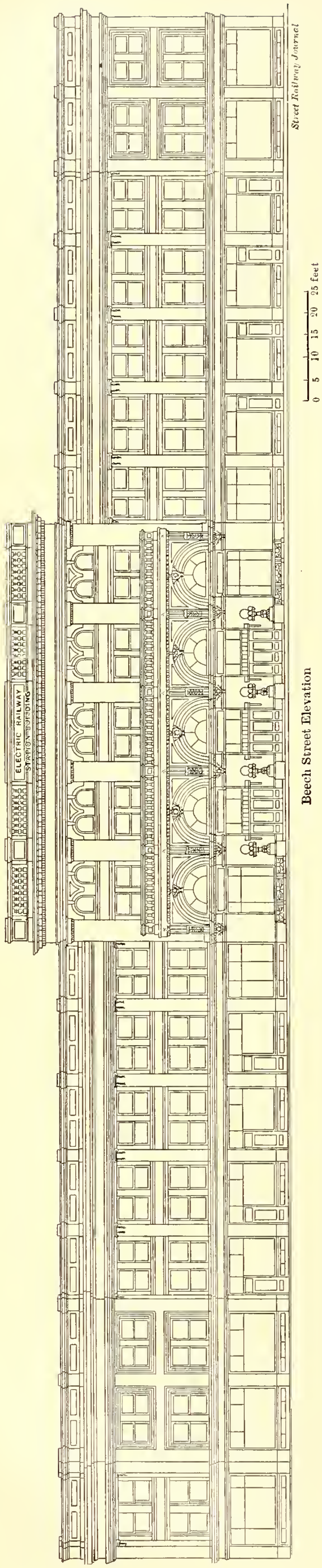
The location of the station is about one block north of the



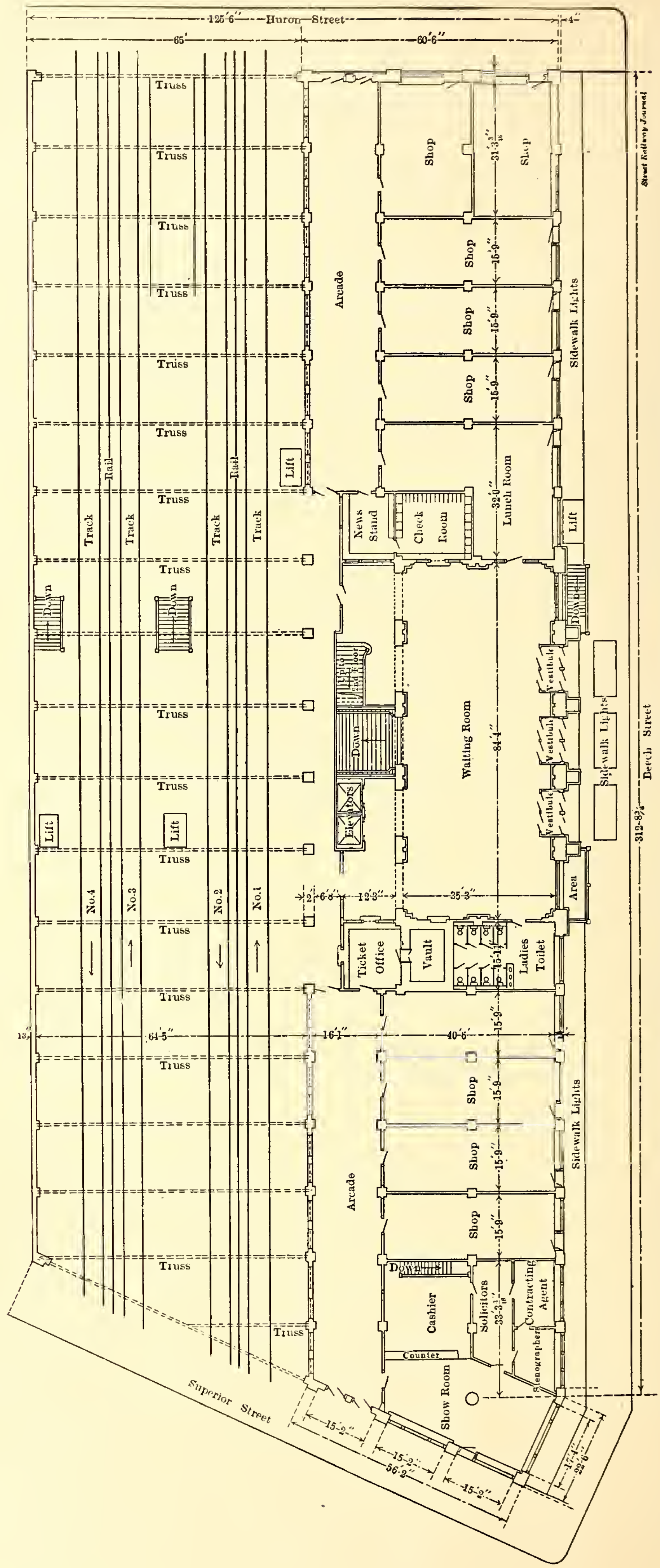
PLAN, SHOWING THE LOCATION OF THE TOLEDO TERMINAL AND THE CONNECTIONS WITH THE ENTERING INTERURBAN ELECTRIC RAILWAYS



PLAN OF THE BASEMENT OF THE TOLEDO TERMINAL



FRONT ELEVATION ON BEECH STREET, TOLEDO, OF THE NEW ELECTRIC INTERURBAN RAILWAY TERMINAL STATION



PLAN OF THE FIRST FLOOR OF THE TOLEDO ELECTRIC INTERURBAN RAILWAY TERMINAL present waiting room at Superior and Adams Streets, and it immediately adjoins the present freight station of the interurban companies. The Toledo Railways & Light Company owns the entire block with the exception of a small piece, and there is ample room for large extensions to the freight station as well as to the passenger station. It is two blocks north of the corner of Superior and Madison Streets, the business center of the city. This removes it somewhat from the most congested district, yet leaves it very near to the shopping and wholesale districts. From an operating standpoint, it is much more advantageous to both the interurbans and the city company than the present waiting room at Superior and Adams Streets. At present the cars traverse the loop formed by Superior, Jefferson, St. Clair and Adams Streets, which is the most congested district in the city, so much so that the city cars are greatly delayed by the loading and unloading of the interurbans, and the latter cannot lay up for a second at the waiting room. Under the new arrangement, the interurbans will use the lop formed by Superior, Cherry and Huron Streets and the station building. As will be seen from the accompanying plan of the business section of the city, the number of interurbans in the congested district will be greatly reduced and there will be no stopping of these cars in that district. The plan of having the freight and passenger stations close together will be an added convenience. Several of the roads handle express and baggage matter in combination cars, and these cars must run to the passenger station to unload passengers and then to the freight station two blocks away for the other matter. Passengers are also obliged to go to the freight station for their baggage, and frequently through connections are missed by the time lost in going from one building to the other.

Altogether the station will be of immense advantage to all concerned. The plans presented are merely the preliminary ones, and many of the details are yet to be worked out. The station will be owned outright by the Toledo Railways & Light Company, and the interurbans will have no interest or management in the enterprise. The contracts for the use of the station have not yet been worked out, but it is understood that the plan will be similar to that adopted for Indianapolis. It may be slightly different, however, owing to the fact that while the Toledo interurbans divide the city fare with the city company, they have a sliding scale, beginning with 1 cent and 4 cents and running down to 2½ cents and 2½ cents after a long term of years.

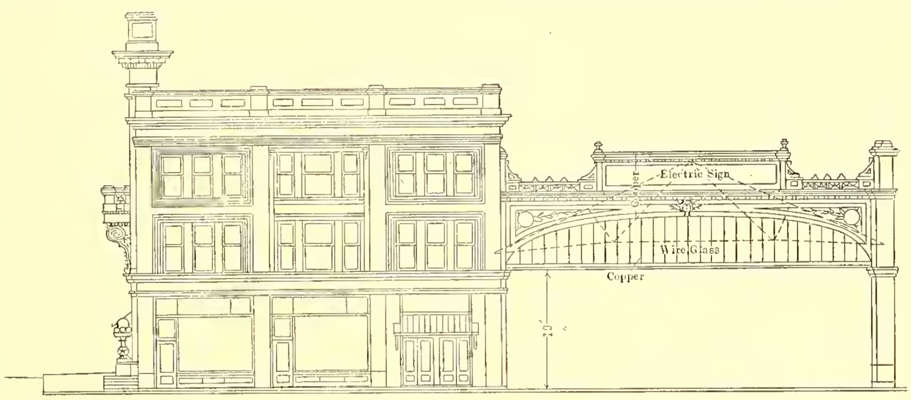
It is stated that the building will cost about $200,000. Plans were prepared by Bacon & Huber, of Toledo, under the supervision of L. E. Beilstein, vice-president and general manager of the Toledo Railways & Light Company.

RECORD OF THE EFFORT TO LIMIT CAR-CARRYING CAPACITY IN CLEVELAND

About two weeks ago the city authorities of Cleveland ordered the Cleveland Electric Railway strictly to enforce the provisions of the health code, which provides that cars shall not be loaded to more than one and a half times the seating capacity. The company has since tried to enforce the law, but its efforts have been largely ineffective. The company declined to instruct its conductors to use force to eject passengers above the limit, but cars have been run past people when the capacity set by the ordinance was reached. As a result, many men have jumped on the cars while in motion, and there has been more than the usual number of accidents. A large number of additional trippers were placed on the various runs, but this only served to increase the congestion of cars in the Public Square district, and the movements of passengers were sl wer than before. Public sentiment is plainly against the move, but the city authorities insist upon enforcing the law. Finding protests in vain, the company secured permission from the city to divert a number of its lines from the Public Square by means of new downtown loops, and on Tuesday, Jan. 23, began to operate under the new plan. The company is thus enabled to take 175 cars an hour off the Public Square during the heaviest rush hour. Protests have been lodged against change of routes, however, as many persons are compelled to walk two or three blocks to transfer in the downtown district. Another annoying feature is that the change diverts some of the interurban lines away from the square, and they are no longer able to utilize the union waiting station and layover terminal.

IMPROVEMENTS IN SEATTLE

Improvements extending to nearly every department of the system are to be made this year by the Seattle Electric Company. Perhaps the most important work planned is proposed for the power supply and the operating departments. The company has purchased a large tract of land just south of Seattle, on which it expects to begin this year a nucleus for a considerable shop and storeroom installation, including car house for housing a portion of the cars of the city system, and also cars and trains of the Puget Sound Electric Railway. The company also expects to begin the construction on the same land of a power station as an additional steam relay to its water-power supply, and will probably install at first a 3000-kw turbo-generator, with boilers and auxiliary machinery, the plan contemplating the beginning of a building which can be extended ultimately to aggregate 30,000 kw.



Huron Street Elevation

HURON STREET ELEVATION OF THE TOLEDO TERMINAL, SHOWING THE ENTRANCE TO THE TRAIN SHED

A number of extensions to existing lines also are contemplated, but the location and extent depend somewhat upon local conditions, and are not yet fully determined. The company will, however, complete the construction of the Fremont Avenue extension from the Fremont railway crossing over Fremont Avenue and other streets to the west side of Woodland Park, and will build an extension to the University line through Ravenna Park and on to Calvary Cemetery. Double tracks are now being laid in First Avenue south from the East Waterway to Spokane Avenue.

The company expects to add to its city equipment twenty-five 30-ft. body, four-motor electric cars, and will build in its own shops two combination open and closed grip cable cars for the Madison Street cable line. In connection with the city, in streets where there are tracks, a considerable amount of relaying of light rail with heavy rail and paving will be done.

POWER PLANT ECONOMICS *

The author began his paper by a brief reference to the changes which were being introduced in power station practice by the development of the steam turbine, and how this had in turn reacted favorably upon the development of the reciprocating steam engine, as well as the internal combustion or gas engine. He wished to direct attention to the basic fact that in power plants one should not look merely for increased efficiency in the prime mover, but should also investigate and analyze the entire plant from the coal to the bus-bars: first, in regard to efficiency; secondly, in regard to the effect of load factor upon investment; and thirdly, the effect of the first and second upon the total cost of producing the kw-hour, which is the ultimate test of the skill of the designer and operator.

In taking up the question of efficiency, Mr. Stott presented the accompanying Table I., which gives a complete analysis of the losses found in a year's operation of what is probably one of the most efficient plants in existence to-day, and therefore typical of the present state of the art:

TABLE I.—ANALYSIS OF THE AVERAGE LOSSES IN THE CONVERSION OF 1 LB. OF COAL INTO ELECTRICITY

	B.T.U.	Per Ct.	B.T.U.	Per Ct.
1. B.t.u. per pound of coal supplied.	14,150	100.0	......	......
2. Loss in ashes	......	......	340	2.4
3. Loss to stack	......	......	3,212	22.7
4. Loss in boiler radiation and leakage	......	......	1,131	8.0
5. Returned by feed-water heater	441	3.1	......	......
6. Returned by economizer	960	6.8	......	......
7. Loss in pipe radiation	......	......	28	0.2
8. Delivered to circulator	......	......	223	1.6
9. Delivered to feed pump	......	......	203	1.4
10. Loss in leakage and high-pressure grips	......	......	152	1.1
11. Delivered to small auxiliaries	......	......	51	0.4
12. Heating	......	......	31	0.2
13. Loss in engine friction	......	......	111	0.8
14. Electrical losses	......	......	36	0.3
15. Engine radiation losses	......	......	28	0.2
16. Rejected to condenser	......	......	8,524	60.1
17. To house auxiliaries	......	......	29	0.2
	15,551	109.9	14,099	99.6
Delivered to bus-bar	1,452	10.3		

In discussing the various items in detail, the author mentioned a CO_2 recording instrument recently placed on the market. He presented the results of a series of tests made with this instrument, and spoke of the improvements made toward reducing the stack losses by thus watching the CO_2 record.

Mr. Stott believed that by carefully watching each source of loss the present type of power plant using reciprocating engines can be improved in efficiency as follows: Reduction of stack losses, 12 per cent; reduction in boiler radiation and leakage, 5 per cent; and reduction in engine losses by the use of superheat, 6 per cent. This would result in a net increase of thermal efficiency of the entire plant of 4.14 per cent, and bring up the total thermal efficiency from 10.3 per cent to 14.44 per cent.

The author presented a typical economy curve of a steam turbine, which showed that the best economy on dry saturated steam is practically equal to that of a reciprocating engine, and that 200 degs. superheat reduces the steam consumption 13.5 per cent. The shape of the economy curve, however, is much flatter than that of the reciprocating engine, so that the all-day efficiency of the turbo-unit would be considerably better than that of the reciprocating engine, with the other great advantage of costing approximately 33 per cent less for the combined steam motor and electric generator.

* An abstract of a paper presented by Henry G. Stott at the 203d meeting of the American Institute of Electrical Engineers, New York, Jan. 26, 1906.

The inherent principles involved in the design of the steam turbine show that it can be expected to give an almost perfect adiabatic expansion, as there are no thermal cycles of heating and cooling at every stroke as in the reciprocating engine; there is an almost ideal thermal drop from the steam valve to the condenser. It is also evident that the expansion will be relatively more nearly adiabatic in the low-pressure stage of the turbine than in the low-pressure cylinder of the engine, so that it has been proposed that the reciprocating engine should be run high pressure where relatively it is more efficient than the steam turbine, utilizing the turbine for the low-pressure part of the cycle. In other words, use each where it is most efficient. This turbo-unit would be interposed directly between the exhaust nozzle of the reciprocating engine and the condenser, and would have no valves or governing mechanism whatever. The generator would be connected directly to the other generator leads without any switching apparatus, except possibly knife switches to disconnect for testing purposes; and in operation no attention whatever would be required beyond the ordinary lubrication of bearings. Such a unit it is evident could be built at a very small cost per kilowatt.

After summarizing the merits and defects of the gas engine, Mr. Stott mentioned that over a year ago, while watching the effect of putting a large steam turbine having a sensitive governor in multiple with reciprocating engine-driven units having sluggish governors, it occurred to him that here was the solution of the gas engine problem; for the turbine immediately proceeded to act like an ideal storage battery; that is, a storage battery whose potential will not fall at the moment of taking up load, for all the load fluctuations of the plant were taken up by the steam turbine, and the reciprocating units went on carrying almost constant load, while the turbine load fluctuated between 0 kw and 8000 kw in periods of less than 10 seconds. The combination of gas engines and steam turbines in a single plant offers possibilities of improved efficiency, while at the same time removes the only valid objection to the gas engine.

A steam turbine unit can easily be designed to take care of 100 per cent overload for a few seconds; and as the load fluctuations in any plant will probably not average more than 25 per cent, with a maximum of 50 per cent for a few seconds, it would seem that if a plant were designed to operate normally with 50 per cent of its capacity in gas engines and 50 per cent in steam turbines, any fluctuations of load likely to arise in practice could be taken care of.

As the thermal losses in the gas engine jacket water amount to approximately 19 per cent, and as the water is discharged at a temperature above 100 degs., it can be used to advantage for boiler feed. The jacket water necessary for an internal combustion engine will probably be about 40 lbs. per kw-hour, assuming that the jacket water enters at 50 degs. F.; then the discharge temperature will be

$$50 + \frac{19 \times 12{,}500}{40 \times 100} = 109.4 \text{ degs. F.}$$

As the steam turbine will require only about 15 lbs. per kw-hour, including auxiliaries, it is evident that only 37.5 per cent of this heat, or 7.1 per cent of the jacket water loss, can be utilized. The other loss in the exhaust gases of 30 per cent can be utilized either in economizers or directly in boilers or superheaters. Thus by utilizing the waste heat in the gas engines for the purpose of assisting to make steam for the turbines, there can be saved approximately 37 per cent of the total heat lost in the gas engine.

In the summary of analysis of heat balance it was shown that one can reasonably expect to bring the reciprocating engine plant up to a maximum total thermal efficiency of 14.44 per cent, or possibily, with steam turbines using superheat, to 15 per cent.

Referring now to Table I. it will be noted that in item 2 the loss in ashes was 2.4 per cent, and the loss to stack in item 3 was 22.7 per cent; now with the hot gases from the gas engine exhaust it is evident that the loss in 2 will not exist, and that item 3 will be reduced from 22.7 per cent to about 5 per cent as the process of combustion is completed in the gas engine. The total efficiency of conversion of this 30 per cent of heat from the waste gases when used in the turbine plant would then be $15.0 + 2.4 + (22.7 - 5) = 35.1$ per cent.

The heat recoverable from the jacket water was shown to be 7.1 per cent of the total heat in the coal, so that there is 30 per cent + 7.1 per cent = 37.1 per cent of the original heat in the fuel returned from the gas engine, and this can be converted into electrical energy at an efficiency of 35.1 per cent. For each kilowatt delivered by the gas engine plant, 3918 B. T. U. will be simultaneously turned over to the steam plant, and this in turn will give 403 watts to the steam plant free of cost.

The steam plant will then have only to furnish 1000 — 403, or 597 watts per kilowatt at a thermal efficiency of 15 per cent; in other words, the economy of the steam part of the plant will be raised to

$$\frac{15}{0.597} = 25 \text{ per cent.}$$

The average total thermal efficiency of such a combination plant would then be

$$\frac{24 + 25}{2} = 24.5 \text{ per cent.}$$

The interest depreciation and taxes on a plant costing $130 per kilowatt, which may be taken to represent a first-class steam or internal combustion plant, was shown plotted in conjunction with various load factors. Another curve was plotted showing the minimum investment with a plant in which the prime mover would be steam turbines and designed otherwise without regard to efficiency, leaving out economizers, feed-water heaters, etc., and thus reducing the investment to $90 per kilowatt. This cheap and relatively inefficient part of the plant would only be operated on peak loads of two or three hours' duration, corresponding to a load factor of 0.1 or less found in possibly 40 per cent of the output of our lighting plants.

In Table II. will be found a tabulation of the relative values

TABLE II.—DISTRIBUTION OF MAINTENANCE AND OPERATION CHARGES PER KW-HOUR

	Reciprocating Engines	Steam Turbines	Reciprocating Engines and Steam Turbines	Gas Engine Plant	Gas Engines and Steam Turbines
Maintenance.					
1. Engine room, mechanical...	2.57	0.51	1.54	2.57	1.54
2. Boiler room or producer room	4.61	4.30	3.52	1.15	1.95
3. Coal and ash-handling apparatus	0.58	0.54	0.44	0.29	0.29
4. Electrical apparatus	1.12	1.12	1.12	1.12	1.12
Operation.					
5. Coal and ash-handling labor.	2.26	2.11	1.74	1.13	1.13
6. Removal of ashes........	1.06	0.94	0.80	0.53	0.53
7. Dock rental	0.74	0.74	0.74	0.74	0.74
8. Boiler-room labor	7.15	6.68	5.46	1.79	3.03
9. Boiler-room oil, waste, etc.	0.17	0.17	0.17	0.17	0.17
10. Coal	61.30	57.30	46.87	26.31	25.77
11. Water	7.14	0.71	5.46	3.57	2.14
12. Engine-room mechanical labor	6.71	1.35	4.03	6.71	4.03
13. Lubrication	1.77	0.35	1.01	1.77	1.06
14. Waste, etc.	0.30	0.30	0.30	0.30	0.30
15. Electrical labor	2.52	2.52	2.52	2.52	2.52
Relative cost of maintenance and operation	100.00	79.64	75.72	50.67	46.32
Relative investment in per cent.	100.00	82.50	77.00	100.00	91.20

of the various items necessary in the maintenance and operation of a power plant. The first column covers a plant with compound condensing reciprocating engines without superheat, and is derived from a year's record of actual costs of a large plant operating with a load factor of approximately 50 per cent; load factor in this case being defined as

$$\frac{\text{Actual output}}{\text{Maximum hour's load} \times 24.}$$

The values in the other columns have in the main been estimated from the first column, but wherever possible actual data derived from various sources, both domestic and foreign, have been used; but in all cases all values have been reduced so as to make them directly comparable with the first column, and with one another. The values in maintenance and operation of steam turbines are derived from actual costs.

SUMMARY

The present type of steam power plant can be improved in efficiency about 25 per cent by the use of more scientific methods in the boiler room, by the use of superheat, and by running the present types of reciprocating engines high pressure, and adding a steam turbine in the exhaust between the engine and the condenser. At the same time the output of the plant can be increased to double its present capacity at a comparatively small cost for turbines and boilers.

The steam turbine plant has an inherent economy 20 per cent better than the best type of reciprocating engine plant, not so much due to its higher thermal efficiency as to a variety of causes shown in Table II.

An internal combustion engine plant in combination with a steam turbine plant offers the most attractive proposition for efficiency and reliability to-day, with the possibility of producing the kw-hour for less than one-half its present cost.

LIGHTNING PROTECTION*

BY J. V. E. TITUS

It is almost unnecessary to say at the start that however "high flown" claims we manufacturers make in our advertising, a complete solution of the subject of lightning protection has not been made—to date. The progress in this direction, however, during the last few years has been considerable. Heretofore the manufacturer of protective apparatus has had the burden of the proposition on his own shoulders alone. The fact that the subject is receiving so much attention before different societies and associations, such as this one, promises well for the future. It is only by careful co-operation between operating companies and the manufacturer that the most rapid progress is made. It is hoped that the operating companies will give even greater attention to the subject now that they have been properly aroused to the situation that confronts the electric railway industry.

By a process of "natural selection" the practical method of protection has resolved itself to a choice of less than a half dozen forms of lightning arresters. In all of these that have proven popular there is the usual air gap, over which the normal current alone cannot jump, but which offers an outlet to earth for the lightning. When the lightning does bridge this air gap the normal current usually follows. And it is the means provided to stop this flow of normal current that gives us—the manufacturers—our chance to tell you so many conflicting tales about which of these means is the worst.

Some of us try to prevent the normal current following the discharge at all. Some of us try to blow out the arc formed by the normal current, while some try to cut it off by means of "moving parts." There are other ways, each one of which has its pitfalls. We are all pretty well agreed, however, that to have the air gap of the arrester small is of great importance.

* Paper presented at the annual meeting of the Ohio Interurban Railway Association, Jan. 25, 1906.

Therefore, remarks relating to other features will prove of greater interest.

I shall first tell you of some of the recent developments of the research and experimental work carried on by our company in the last few years. This work covers practically all types of arresters on the market at present, but was devoted almost exclusively to the improvement of our own product. As the greater portion of your mileage is operated by direct current of 500 volts to 700 volts, my remarks will be confined to this class of service. With properly designed arresters, properly distributed and with good ground connections, no further precautions than careful inspection at frequent intervals can be taken.

DESIGN

In the design of a lightning arrester there may be all the difference in the world. It has been easy to make one that will discharge a circuit freely. It has been easy to make one that will prevent a continued flow of normal current following the discharge. But to combine both of these features in the same device has been quite a problem.

It is generally conceded that an electric line is a poor place to allow the lightning to linger. Experiments were made, therefore, as to the most efficient method of discharging a circuit. Lightning may be likened to water in some of its characteristics. When it breaks loose it goes with a rush. If you dumped a bucket of water through a straw, a whole lot of it would splash over; if you dumped it through a large enough pipe, you wouldn't spill a drop. It's something like this in a lightning arrester. The path to earth must be as free from resistance as possible. With a high resistance path for the lightning, some of it may splash over and "wet" your machinery or insulation, as the water does if you dump it through a straw. But by making the resistance of a lightning path low, you insure a complete and instantaneous discharge.

Resistance in a lightning arrester may not impede a light static discharge to the extent that it does a sudden rush of current, such as lightning. I believe Alexander J. Wurts, the eminent authority on lightning protection, has said that discharging lightning through a resistance in series with an air gap may be likened to the swing of a pendulum. If an empty glass jar is placed in the path of the pendulum, the glass jar will be broken and the pendulum swing onward in its path freely. But if the glass jar is filled with water, the pendulum will break through the glass as a discharge does the air gap of a lightning arrester, but the speed of the pendulum will be greatly decreased by its passage through the water. The speed, or freedom of passage of the discharge, is impeded by the resistance of a lightning arrester in the same way as that of the pendulum is by the water. Mr. Wurts, therefore, made his famous nonarcing lightning arresters for alternating-current service perfectly free from any resistance aside from that of the air gaps.

The foregoing remarks are completely confirmed by our research work, and will establish the desirability of keeping the discharge path as free from resistance as possible. How this is done will follow in my further remarks. But our observation has been that to keep down the resistance in the discharge path is of prime importance in correct arrester design.

DISTRIBUTION

The distribution of a large number of lightning arresters along the line, in addition to those on each car and those at the station, is rapidly becoming standard practice. Its desirability is apparent for many reasons. Lightning shows a tendency to take the closest and shortest path to earth that it can find, even though it be of high resistance, as shown by the reports from long-distance transmission lines. No arresters are used along such lines, as the development of arresters for such voltages has not yet reached the stage where they can be hung on a pole, unattended, to battle single handed with the most elusive of the elements. As a result, poles are frequently shattered by lightning discharges from the line, as well as direct discharges from the clouds. This is probably due to the inductive resistance of considerable lengths of even perfectly straight wires. This induction tends to drive the discharge through the insulation and the wooden poles to the earth, thus showing most forcibly the tendency of lightning to find an immediate outlet to earth.

By placing arresters sufficiently close together, say every 1000 ft. or closer where storms are very severe, the discharges are offered plenty of proper paths to earth, without endangering the machinery or the insulation. In the event of very heavy discharges, such as frequently occur on long exposed interurban lines, it is almost impossible to have too many arresters. A large number insures each one doing its part of the work, and in this case there is no over-plus to go through the insulation.

The nodal or non-discharge point theory has been well established, and at such points a discharge will not go to earth. The use of a large number of arresters along a line insures a sufficient number of them at points where discharges will occur. Furthermore, when a storm is of long duration and very severe, a certain part of the arrester equipment may be seriously damaged. The more arresters there are on the line, when such a storm begins, the more there will be at its ending. The more arresters used, the less service each one has to perform and the less danger of its being overloaded, which shortens its life.

CONNECTIONS

To insure proper ground connections at all times, we recommend a connection to the rail as well as to a ground point. There are several reasons for this—first of all our own. This is, that the arrester requires a certain flow of normal current to properly actuate the cut-out. If the ground wire is not connected with the rail there may be enough resistance between the rail and the ground point to cut the current down to so small a value that the cut-out will not operate properly. Another reason for the double connection is the probability of the static difference of potential existing between the rail and the earth, or between the rail and the line, particularly if the rail is upon a rock-ballasted roadbed or set in cement or a soil that does not offer a good outlet for the discharge. By grounding to rail as well as the earth, the arrester is placed in a shunt path around the car motors, which affords them the best possible protection under all circumstances. With ground connections to both rail and ground point, any corrosion or breakage of one of these connections will leave the other intact in all probability, thus insuring at all times a good outlet for the lightning.

INSPECTION

A regular inspection and test of all arresters should be made once a month, and additional inspections after severe storms. At such times the discharge points should be observed and cleaned if necessary. Dust and dirt accumulated on the base should be blown away. A small pair of hand bellows is convenient for this work. If any evidence of damage is shown, the arrester should be taken to the repair room for test and overhauling.

Many electric railways are making a practice at the present time of taking down all pole type lightning arresters during the winter months. These are given a careful test in the shop, particular attention being paid to resistance rods, to determine whether or not they have increased in resistance. Any repairs necessary are made in the shop, where they should be, instead of on the line, where the lineman has poor chance of doing careful work.

It is careful attention to the small details of a lightning equipment that brings successful lightning protection, especially if the lightning arresters are of an efficient and durable design. The fact that we are dealing with such an erratic and practically unknown element should impress us with the need of unflagging effort to have the lightning protective apparatus at all times in first-class condition.

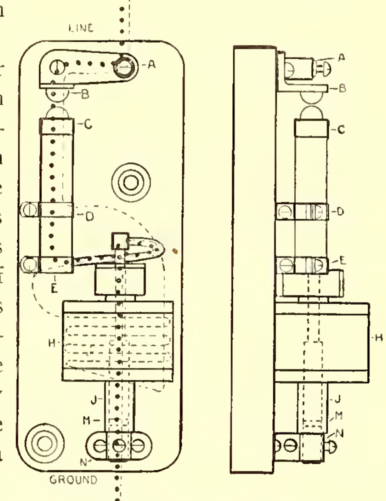
While our experimental work covers many of the different arresters on the market, particular attention is given to our own types, as previously stated. Service results had conclusively shown that while our make of arresters was highly efficient in discharging a circuit, after a season or two of severe storms the number of burned out arresters was disconcerting, to say the least. Arresters that have been burned out are generally so completely wrecked that it is difficult to find enough partially damaged ones on which to base a report of the real cause of the trouble. But careful observation showed that the resistance rods were at the bottom of more than 60 per cent of the burn-outs. The composition of the rods available in past years was principally some combination of graphite or carbon with kaolin, a fine grade of clay, such as used in porcelain. Under the action of lightning, these rods increased in resistance, almost beyond reason; for instance, a rod of 100 ohms would often be increased to 10,000 ohms after a few storms. This high resistance was sufficient to choke back the lightning or force it to find another path to earth, frequently over the surface of the arrester base, resulting in its destruction if the normal current followed this path. This increase of resistance seems to be due to the union of the free carbon and the silicon of the material from which the rod was made. The product of the union caused by the static discharge was a film of something like carbide of silicon or carborundum. This film existing between conducting particles was responsible for the increase in resistance. This weakness of resistance rods has been entirely overcome by making them with a high percentage of metallic conducting materials. The other substances used are carborundum and kaolin, to give strength and stability. The rods now produced by our company are not increased in resistance by the action of the static discharge.

Another cause of burn-out was found to be the arrangement of the parts of the arrester on the base. When dust collected and, later on, moisture due to sudden changes of temperature, the discharge or even the normal current would flash across the base between arrester parts. This formed a short-circuit and soon resulted in the destruction of the device.

To avoid the possibility of such an occurrence the arrester parts have been so distributed on the base that the line connection is at one end and the ground connection at the other extremity, as shown in this diagram. In this way parts of greatest difference of potential are most widely separated. In addition to the arrangement of parts, the method of supporting the resistance rod, as shown in this illustration, greatly increases the distance on the surface of the base between parts of opposite potential. The rod is supported by clamps and brackets *D* and *E*, which gives 2½ ins. surface distance between *B* and *D*. The discharge point *C* is cemented on the upper end of the rod, the other discharge point, *B*, being mounted on an adjustable bracket.

A brief description of the method of operation of this new type of arrester may be of interest. The line connection is at the top of the arrester, as shown. A discharge entering here passes downward in a practically straight path to ground connection. This path is indicated by the heavy dotted line in the diagram. The light dash line shows the path of the normal current. It will be noticed that the discharge goes through the entire length of the resistance rod *C-D*, the normal current being shunted through the solenoid coil *H*. This energizes the iron armature *J*, which raises upward in the coil, opening the circuit between the lower end of the armature and the carbon button *M*, which is connected with the ground binding post *N*. This starves the arc formed at the air gap *B-C*, so that it ceases and the normal dielectric of same is re-established. The coil loses its energy and the armature returns by gravity to its normal position. The arrester is instantly ready for another discharge. As the arc is broken between the iron armature *J* and the carbon button *M*, these two materials cannot stick or weld together; and as the circuit is opened inside the tube and the air-gap adjustment is always the same, it is possible to use the small air-gap standard in this type of arrester, viz., 1-40 in. To limit the flow of normal current that can follow the discharge to ground, the upper section of the resistance rod is used, there being approximately 50 ohms resistance between the discharge point *C* and the clamp *D*. This resistance keeps the current down to a value that is readily broken by the cut-out, and is not enough resistance to impede the passage of the discharge.

It will be noticed that the parts of the arrester are readily accessible from the front. This allows a lineman to inspect, clean or repair the arrester without removing it from its box or the pole.



WORKING PARTS OF NEW LIGHTNING ARRESTER

It has been my endeavor to avoid technicalities in these remarks, as the practical side of the question has resolved itself into the important one. What is wanted is results. To this end comparative tests of different types of arresters should be made in the laboratory as well as in the field. No single laboratory test alone can establish the efficiency or durability of a certain arrester. These tests have been made, however, under all sorts of conditions, and the showing is something like that of the photometric tests of incandescent lamps, made by different salesmen. These tests were certain to show the best results for the lamp the salesman was offering. There are certain test specifications for lightning arresters that must be complied with to give a fair result.

There is in New York City, as you are probably aware, a laboratory that undertakes just such tests. Its standing is of unquestioned character. It seems that its report may be relied upon as beyond appeal. It may, at least, to the fullest extent that any laboratory test can be. The ultimate test of real value is, of course, the one made in service, under widely varying conditions.

I wish to express our appreciation of this opportunity of meeting with you, and would call your attention again to the progress that is possible by the closest co-operation between yourselves and the manufacturers of lightning protective apparaus. To this end I assure you the most willing assistance of our company.

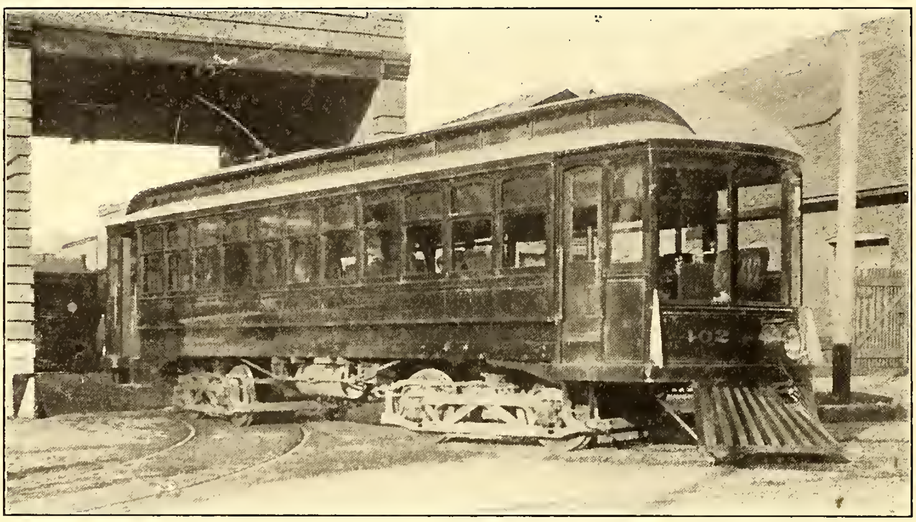
BERLIN PLANS TO TAKE OVER RAILWAY LINES

At a conference of the Berlin municipal authorities Jan. 29 with the municipal officers of eight suburban towns, including Charlottenburg and Schoeneberg, it was resolved to take the initiatory steps to acquire the Berlin Street Railway Company, which has the monopoly of the street railways of Berlin and its suburbs, and to operate roads upon the joint account of the municipalities referred to. The company has a capital of $25,000,000, and its system has been described in previous issues of this paper.

ORGANIZATION OF THE CENTRAL ELECTRIC RAILWAY ASSOCIATION

After two years of usefulness, the Ohio Interurban Railway Association passed out of existence at a meeting at the Algonquin Hotel, Dayton, Jan. 25, and in the evening its successor, the Central Electric Railway Association, formed by the merger of Ohio and Indiana associations, held its first gathering at a magnificent banquet, where the new officers were installed by nearly 300 members, representing not only the two States mentioned, but several adjacent States. The work of the new association will effect the interurban lines of the Central West, and it will be made doubly effective through the establishment of a permanent headquarters and a salaried secretary, who will devote his entire time to furthering the interests of the members.

At the morning session the proposed constitution and by-laws of the new association were read and adopted by the Ohio members, having been previously passed upon by the Indiana Association. It follows closely the plans of the old associations, except that the scope is broadened to take in members from adjoining States. Meetings will be held every two months instead of monthly, with an intermission of four months during the summer.



PARLOR CAR "LAWTON," OF THE FORT WAYNE & WABASH VALLEY RAILWAY, WHICH CARRIED A SPECIAL PARTY FROM INDIANA TO THE DAYTON CONVENTION

The new officers chosen by nominating committees from both States and ratified at this meeting are as follows: President, E. C. Spring, Dayton, Ohio; first vice-president, C. L. Henry, Indianapolis, Ind.; second vice-president, F. D. Carpenter, Lima, Ohio; treasurer, W. F. Mulholland, Indianapolis, Ind. Executive committee: F. J. Sloat, Hamilton, Ohio; Theodore Stebbins, Columbus, Ohio; Harrie P. Clegg, Dayton, Ohio; J. W. Brown, Connellsville, Pa.; C. N. Wilcoxson, Cleveland, Ohio; W. G. Irwin, Columbus, Ind.; C. D. Emmons, Fort Wayne, Ind.; Gardner Wells, Terre Haute, Ind.; C. C. Reynolds, Lafayette, Ind.; H. A. Nicholl, Anderson, Ind. The selection of the secretary was left open for the first meeting of the executive committee.

At the afternoon session J. V. E. Titus, of the Garton-Daniels Company, Keokuk, Iowa, read a paper on "Lightning Arresters." This paper is published elsewhere in this issue.

George Whyshall, of the Columbus, Delaware & Marion Railway, took exceptions to the plan of taking down lightning arresters in the fall. He said that one of their most severe thunder storms occurred only a few weeks ago, and that they would have been seriously damaged had all the lightning arresters been down.

Mr. Titus explained that he had not intended to convey the idea that all the arresters should be taken down at once. His idea was to remove every third or fourth arrester and inspect and replace it as rapidly as possible, so that all the arrester equipment would be in first-class order in time for the spring storms.

Asked as to the best method of grounding an arrester, Mr. Titus recommended driving a pipe into the ground, reaching moist earth, and said that the pipe should be carried up the pole 8 ft. to 10 ft. to prevent malicious damage to the wire. A brass cap should be placed over the pipe and carefully soldered to prevent induction, which would tend to impede the discharge. For station arresters, he advocated a large copper or cast-iron plate embedded in charcoal.

Mr. Whyshall said their station was built on rock with a dry soil 4 ft. or 5 ft. deep. In order to secure a good ground, they drilled several holes 25 ft. to 30 ft. deep and 100 ft. apart. They inserted in these holes a 30-lb. rail, surrounded by several copper wires, and a considerable amount of pulverized coke was poured into the holes.

J. A. Bendure, of the Toledo & Lima Traction Company, said that too many workmen simply wound a wire around a pipe and called it a ground. They had trouble for a time with lightning arrester grounds, which he finally remedied by digging to moist ground and inserting a copper plate 1 ft. square and ½ in. thick, and driving to this an iron pipe. The pipe was filled with charcoal, and during dry weather they frequently pour water into the pipe. For five years they have had no trouble.

Theodore Stebbins, of the Appleyard system, recalled the early days when a severe lightning storm frequently resulted in burning out all the car motors. He thought that this had been remedied largely by the use of better insulation. He thought that the term lightning arrester was a misnomer, as the function of the device was to divert, not to stop the discharge.

F. J. Sloat, of the Cincinnati Northern Traction Company, thought that troubles frequently arose from grounding to the rail. Some grounds of this kind on their road had been tested and found faulty and had to be changed.

The handsome banquet hall at the Algonquin was beautifully decorated for the first session of the Central Electric Railway Association. Back of the toastmaster's seat was a large floral emblem bearing the words "Ohio and Indiana."

President Spring opened with an address of welcome. He referred to the successful history of the Ohio Interurban Railway Association during the previous two years, and to the effective way in which the administration had been supported by the executive committee and by the different members. He mentioned the introduction of the interchangeable coupon book, the creditable work of the secretary, Mr. Coen, and the valuable assistance rendered by Mr. DeWeese while treasurer. As president of the Ohio Association, he extended the right hand of fellowship to the Indiana members, and as chairman of the joint committee which was appointed by both associations to carry out the amalgamation, he congratulated both States upon the unanimity of purpose exhibited by the committee. He referred to the extensive system of interurban electric lines which had been built up in the States represented by the new association, and which represents an invested capital of $300,000,000 and about 4500 miles of interurban track. He urged all the members to make arrangements so that so far as possible the heads of all the various departments should attend the future meetings of the association. He referred to the honor which he felt in being elected to the office of president of the new association, and believed that the maxim of the members should be that expressed by Admiral Nelson before the Battle of Trafalgar, that every man should do his duty. If every member should see to it that he gives his work and his interests toward shaping the best future of the association, even greater results may be expected than have been experienced in the past.

The guest of honor, W. Caryl Ely, of Buffalo, president of the American Street and Interurban Railway Association, gave a stirring address on matters of vital importance to the work. Mr. Ely referred to the spirit of hearty accord and co-operation which seemed to be universally manifested in the association, and congratulated the members on this spirit. He advocated a policy of publicity in street railway corporate affairs, and believed that the better the general public understood the electric railway business and the conditions under which it is done, the fairer will be their treatment of this important industry. He mentioned various reforms which were urgently needed, as in connection with long-term franchises and transfers, and advocated the repeal of the law which compels a company to issue as much capital as is represented by its mortgage bonds. This, he thought, leads to overcapitalization. He also believed in the appointment by the Legislature of a Board of Railroad Commissioners, and advocated a broadening of the powers of the Interstate Commerce Commission.

F. W. Coen, the retiring secretary, read letters of regrets from invited guests who were unable to be present, among them Herbert H. Vreeland, of New York; Gen. Bancroft, of Boston; T. E. Mitten, of Chicago; Frank W. Hoofer, of Denver; Henry A. Everett, of Cleveland; W. Kelsey Schoepf, of Cincinnati; Gov. Hamlin, of Indiana, and Gov. Patterson, of Ohio.

President Henry, of the Indiana Association, was the next speaker. He spoke of the work accomplished by the two associations, giving credit to Ohio for inaugurating the movement. He urged close co-operation and strenuous action for the new association. He said that the interurban roads were close to the hearts of the common people, and that so long as they catered to the wants of this class they would secure all the concessions that were right. He invited all to attend the next meeting to be held at Indianapolis, March 22.

Harrie P. Clegg, of Dayton, made a most humorous address. In closing, he referred to the valuable services rendered to the Ohio Association by President Spring, and then presented Mr. Spring with a beautiful silver and glass decanter, the gift of his associates in the association.

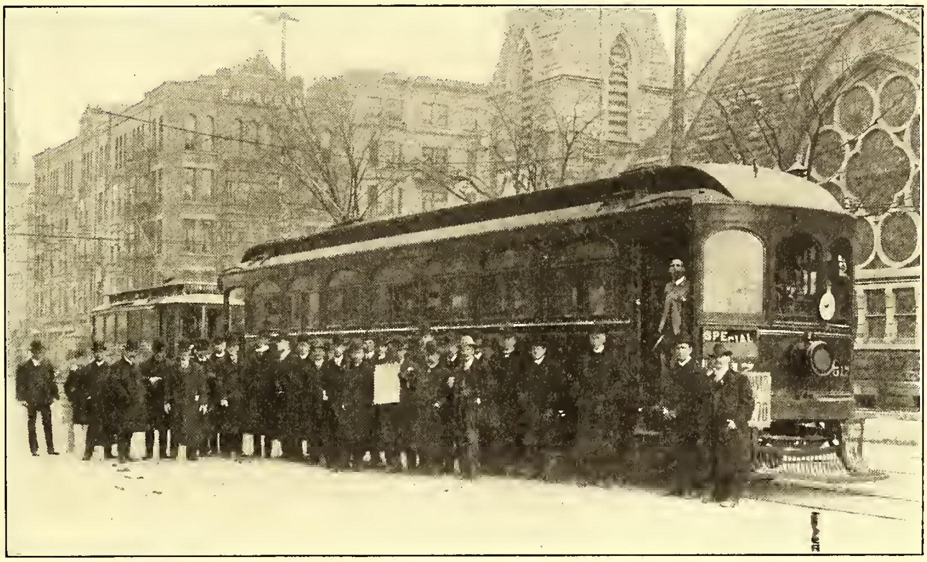
Henry W. Blake, editor of the Street Railway Journal, said that the gathering marked an important epoch in the history of electric traction. Ohio and Indiana had been leaders in the early developments of the industry, and at present surpass other States in the mileage of their interurban lines. Their practice on matters of equipment, train despatching, block signal systems, freight development, etc., and the future work of the new association will be watched with vital interest, not only throughout this country, but all over the world.

T. Russell Robinson, of the Boston Industrial Company, spoke of the differences between the so-called interurban lines of New England and those of this district. He expressed himself as amazed at the long distances covered, the speed of cars and the character of the equipment. He advocated the need of a State Railroad Commission in Ohio.

Judge C. W. Riley, of Detroit, followed with a bright picture of the future that awaits traction lines, which he thought would soon supersede steam lines in the short-haul business. He deprecated the efforts of some roads to secure long-haul freight business, and advised that they stick to the passenger business, making good and frequent service the paramount aims.

Bernard V. Swenson, secretary of the American Street and Interurban Railway Association, said that the success of the new association depended upon organization and co-operation. He thought that the new association should co-operate with the national organization, and he outlined the work and plans of the national secretary's office.

J. Sprigg McMahon, of Dayton, attorney for several of the roads, suggested that traction attorneys be invited to attend meetings of the association and hold a small gathering of their own to discuss legal matters. He urged that immediate steps be taken to appoint a legislative committee to investigate measures now before the Ohio Legislature, a number of which he characterized as most detrimental to traction interests. He spoke of one bill which provides that all grants by municipalities shall be referred to the people to be passed by vote. This,



ATTENDANTS AT THE DAYTON CONVENTION, WHO ARRIVED ON THE SPECIAL CAR OF THE DETROIT, MUNROE & TOLEDO RAILWAY. THIS CAR COVERED 720 MILES IN GOING TO AND RETURNING FROM DAYTON

he said, would result in endless delays in matters of changes and improvements, which are of no consequence to the people, but important to companies. Another undesirable bill provides that roads shall be taxed according to the market value of their securities instead of being assessed by county boards.

A. F. Broomhall, of Detroit, made a plea for greater regard to little things that cause friction between farmers and traction lines. He advised a courteous attitude toward the general public and liberal compromises on debated points.

The success of the very enjoyable banquet and gathering was due largely to the efforts of the local committee at Dayton, headed by A. W. Anderson, of the Dayton & Xenia Traction Company, who had charge of all arrangements.

Some remarkably long trolley trips were made by members who attended this meeting. President Mathew Slush, of the Detroit, Monroe & Toledo Short Line, brought a large party of Michigan delegates from Detroit to Dayton in a special car, which made the run of 232 miles in very fast time. The following day this party continued on to Indianapolis, then up to Logansport, and returning by way of Fort Wayne, Lima, Findlay and Toledo, a total of about 720 miles. This is the longest continuous trip ever made by a single electric car, and the first time that a Michigan car has been seen in Central Ohio or Indiana. Delegates from Northern Indiana traveled to Dayton by way of Fort Wayne and Lima in the private car Lawton of the Fort Wayne & Wabash Valley Traction Company, while members from Central Indiana traveled from Indianapolis to Dayton on the Dayton & Western "Interstate Limited."

CORRESPONDENCE

CURVE WEAR ON THE BOSTON ELEVATED

WILLIAM WHARTON, JR., & COMPANY, INCORPORATED

Philadelphia, Pa., Jan. 30, 1906.

Editors Street Railway Journal:

In your issue of Jan. 27, in an article headed "Curve Wear on the Boston Elevated," you have a drawing showing forty-four days' wear of standard Bessemer steel rails upon a curve of the Boston Elevated Railway Company, the rails being then worn out. You also give drawings showing the wear of manganese steel rails, furnished by us, which, after the Bessemer rails were worn out, were placed upon the same curve, showing their gradual and remarkably small wear, in comparison with the Bessemer steel rails, for periods ranging from 365 days up to 1276 days (Oct. 23, 1905), being twenty-nine times the life of the Bessemer steel rails. You also state that the manganese steel rails were removed from this curve on the latter date, which is entirely contrary to the facts of the case, as the manganese steel rails are still in service and in excellent condition. If kept in the track until they shall be worn away as much as the Bessemer steel rails were worn away before they were taken out, the life of the manganese steel rails will then be more than sixty times as great as the life of the Bessemer steel rails.

As the above error in your issue of Jan. 27 is a very important one, I call your attention to it, knowing well that you will make such correction as may be needed.

Wm. Wharton, Jr., President.

[Mr. Wharton's letter emphasizes the remarkable wearing qualities of manganese steel rails under conditions of great wear, and we are pleased to publish the correction to which he calls attention.—Eds.]

HISTORY OF THE CONDUIT SYSTEM IN WASHINGTON

Ithaca, N. Y., Jan. 24, 1906.

Editors Street Railway Journal:

In the report on the San Francisco street railway situation by Wm. Barclay Parsons, published in your issue of Jan. 6, the statements are made that the adoption of underground conduit electric traction by the street railways of Washington, D. C., was the result of an accident, and that all these lines were formerly operated by cable. Inasmuch as the writer lived in the city during the entire period of development of mechanical traction, and, furthermore, made a somewhat detailed investigation of it a few years since, a correction of the statements made by Mr. Parsons does not seem out of place.

The street railways of the District of Columbia are operated by two companies: the Capital Traction Company, operating 40.69 miles of road, and the Washington Railway & Electric Company, operating 121.28 miles. This latter company is an operating company controlling a majority of the roads in the District.

The Metropolitan Railroad Company, now a part of the Washington Railway & Electric Company, was required by an act of Congress, in effect Aug. 2, 1894, to operate its lines by some form of underground electric construction, the time allowed for equipping the system being one year for the Ninth Street line and two years for the F Street line. As none of the so-called "systems" in use up to that time was at all satisfactory, the company's chief engineer, A. N. Connett, drew up his own plans and constructed on the Ninth Street line a conduit road, which has been highly successful and is at present in operation. With slight modifications, the same construction was adopted on the F Street line, and later installed on all lines of the Washington Railway & Electric Company within the city limits.

In the early nineties the Capital Traction Company, being also required to adopt some form of mechanical traction, installed a very complete and up-to-date cable system, which was operated with some success up to the fall of 1897, although the lines were too long and had too many curves to make the system entirely satisfactory. At the latter date a severe fire totally destroyed the company's large power house, which operated the main part of the system. Within twenty-four hours after the fire, the directors met and decided to install an underground electric system in the cable conduits. The system was installed and began operation in 1898, and it was so successful that the company also changed its Seventh Street line, about 5 miles in length, which was still operating by cable, to the electric system.

The total mileage of these roads operated by conduit was given by the United States Census report of 1903 as 85.08 miles, of which 29.69 was operated by the Capital Traction Company. Of the remaining mileage, 22.67 was changed by the Washington Railway & Electric Company from horse to electric operation before the Capital Traction Company had given electric power serious consideration. Only one of the lines of the Washington Railway & Electric Company, that on New York Avenue, 5.54 miles long, was ever operated by cable.

A. Morris Buck, Jr.

THE STARTING OF ROTARY CONVERTERS

Brooklyn, N. Y., Jan. 31, 1906.

Editors Street Railway Journal:

It was not the intention of the writer, at the Dec. 15 meeting of the A. I. E. E. (see Street Railway Journal, Dec. 23, 1905), to have others infer that converters could not be started from the a. c. side when equipped with pole dampers, for such is not the case. Converters have been started in this manner, but the starting current was excessive. The writer has one instance in mind in which a converter equipped with the most approved form of pole dampers was so started with a starting current of about three times full load, or twelve times that required when starting from the d. c. side with a regular starting set. The starting current which a converter draws is largely dependent upon the self-induction of the armature circuit. If the converter is equipped with pole dampers of approved and effective form, it is found that these dampers act as the closed secondary of a transformer, neutralizing the self-induction of the armature. The writer sees no reason why a converter could not be started from the a. c. side by means of an approved form of starting reactance, so that the converter could be equipped with pole dampers. It is true that many converters installed without pole dampers have operated so far satisfactorily, but now and again it becomes necessary to equip one of these converters with some form of damping device, due to hunting troubles.

As regards the best method of starting converters, it may be interesting to note the results of an investigation on this point conducted by a large corporation in New York which decided to equip its lines with electricity. The result of this investigation was the decision to dispense with all forms of starting sets and induction motors, and so to arrange the windings of a converter that it could be started either by low-potential taps connected to the a. c. side or from the d. c. bus-bar. The advantages of this decision are at once apparent. Under ordinary service conditions, the converters will be started from the d. c.

side, but in emergency cases where time is a very important factor, the converters will be started from the a. c. side.

In starting converters from the d. c. bus, it is found that sudden changes in the bus pressure result in wide fluctuations in the current input of the converter when all of the starting resistance has been cut out. The reason for this is obviously a low armature resistance and the inability of the armature, owing to its inertia, to change its counter e. m. f. with sufficient rapidity. To avoid these fluctuations, Charles F. Scott has suggested that the last point on the starting rheostat be left in while synchronizing. The steadying action of this resistance is similar to that of an arc lamp resistance. This method has been employed with great success by H. G. Stott, of the Interborough Rapid Transit Company, in some of the Interborough sub-stations.

Sidney W. Ashe.

NEW ENGLAND STREET RAILWAY CLUB

The January meeting of the New England Street Railway Club was held at the American House, Boston, on the evening of Jan. 25. President Potter was in the chair, and the speaker of the occasion was Albert B. Herrick, of New York. His topic was "Pointers on the Economical Maintenance of Street Railway Property."

Mr. Herrick emphasized the enormous amount of money expended annually in the United States for the maintenance of street railways, and stated that at the lowest estimate the abnormal maintenance of the companies east of the Mississippi, and between Kentucky and Canada, is $17,500,000 per annum. At first sight it would seem that certain classes of service would be characterized by very high maintenance costs. One would expect a service having heavy grades and many stops per mile would be inseparable from excessive wear and tear upon the equipment, but Mr. Herrick's analyses of the physical conditions present upon many roads in the country show that the character of service has nothing whatever to do with the matter. The lowest maintenance cost per car-mile is found on the roads having the heaviest service. California has the best record, largely because the lines in that State are so far removed from the supply markets. When supplies are easy to get, the maintenance cost is likely to be high, but when it is hard to secure supplies, there is a much greater stimulus to make repairs over and over.

Maintenance is always lower when there is harmony between the operating and maintenance departments. In cases where the officials are encouraged to visit other roads and observe labor-saving devices and up-to-date methods elsewhere, the best results have been secured. The highest maintenance arises in the cases of roads which are not in touch with other progressive lines. The better plan in maintenance work is not to wait until something happens, but to anticipate to-day what is likely to happen to-morrow. Mr. Herrick exhibited a considerable number of diagrams showing the relative maintenance costs upon various roads, and pointed out the great differences in the figures. He stated that if the maintenance expense per car-mile presented on one road could be reproduced on another specific system, the annual saving would be at least $1,000,000.

The cost of power in a street railway plant should be considered as the expense of manufacturing a definite finished product from raw material. Ordinarily the items of labor, coal, oil and waste are all that are considered in calculating the cost of power production. In order to figure the true cost of power, fixed charges based upon the investment should be introduced, although very few roads follow this practice.

Mr. Herrick described briefly his autographic test car, and pointed out its sphere of usefulness in determining the physical conditions of feeder systems, bonds, the track, joints and rolling stock. This car has now covered about 8000 miles of track and recorded the condition of some 2,700,000 bonds. About 1 ton of paper has been used in the apparatus. The drop across the terminals of a rail-bond can be recorded by the milli-voltmeter of the Herrick car when the car is making a speed of about 10 m.p.h. The records of the apparatus are obtained by allowing high-tension discharges to pass along the milli-voltmeter needle through the moving paper, the puncture marks giving the indication desired. Line losses can be studied with great convenience, and it is very important to know where and how the losses occur, so that the feeder layout can be changed if necessary. Losses in distribution reflect on the power cost and also upon the heating of the equipment. When peak loads occur at different times, it is generally a good plan to tie feeders together so that they will reinforce each other, but there is not much to be gained by this practice when the duties of each feeder are practically the same in regard to the time of heavy service. The study of underground conditions is important, particularly as bonds and other wires are often heedlessly broken by workmen. Mr. Herrick then showed how the power consumption is in some respects an index of the general depreciation of the system, citing the case of a road which increased its power consumption in kw-hours per car-mile from 1.8 to 3.5 from 1901 to 1904. By connecting the test car or equivalent apparatus to about 1000 ft. of street railway line and track, the performance of different cars can be determined without the knowledge of the motormen.

At the conclusion of Mr. Herrick's address a discussion was started, and several interesting points were brought out. The resistance of the earth varies greatly with temperature near the salt water. Mr. Herrick said that for general approximations one could consider that 1 sq. yd. of earth against a rail has a resistance of 40 ohms, whereas the same area of concrete has a resistance of 120 ohms. A remarkable point which Mr. Herrick's tests show is that the older equipments have the lowest cost of maintenance. In Ohio, apparatus built in 1893 and 1894 shows the lowest maintenance, and in Albany, N. Y., the "12a" motors in use in that city have a remarkable record in the way of moderate repair charges. Mr. Herrick said that his tests indicate that the safe temperature rise in a railway motor for all-day service should not exceed 22 degs. C. above the surrounding air; a rise of 32 degs. is of very doubtful safety, and a rise of 42 degs. prohibitive and highly dangerous.

J. W. Corning, of the Boston Elevated Railway Company, mentioned the increase of load which occurs upon that system as the temperature decreases. It is almost exactly .7 of 1 per cent per degree fall between 70 degs. F. and 10 degs. F. The explanation is difficult to give, for the resistance of the metallic circuits decreases with the decrease of temperature. Possibly the resistance of the earth increases as the temperature falls, so that the total resistance of the return circuit is enough greater to considerably offset the conductor resistance decrease. Mr. Corning offered no explanation, but John Lindall suggested that possibly the influence of the temperature upon the bearings of the rolling stock might be a factor.

Mr. Herrick spoke highly of electrically-welded joints, as he had investigated their conductivity, notably in Rochester, Cleveland and Brooklyn. The quality of the cast-welded joint depends largely upon the temperature at which it is made. In good practice a 180-lb. weld on a 90-lb. rail will have a resistance equivalent to about 18 ins. of service rail. Mechanical bonds are no better than the man who puts them in. They should never be installed in damp weather. With a good hole and compressor driving they should last five years. Soldered bonds have a tendency to come off in cold weather, though there is no doubt a future for this type. At present they seem to lack the mechanical stability desired. Two fertile causes of increased power consumption are the rubbing of brake-shoes set too tightly against the wheels and the turning on of power before the brakes are released. The meeting adjourned at 10 p. m., with a vote of thanks to the speaker.

IMPACT MACHINE FOR TESTING BRAKE-SHOES

Some years ago the Lappin Brake-Shoe Company, of Bloomfield, N. J., built an impact machine for testing the uniformity of brake-shoe body metal. Owing to the effectiveness and simple construction of this machine, similar ones were installed later in the works of all the other branches of the American Brake-Shoe & Foundry Company.

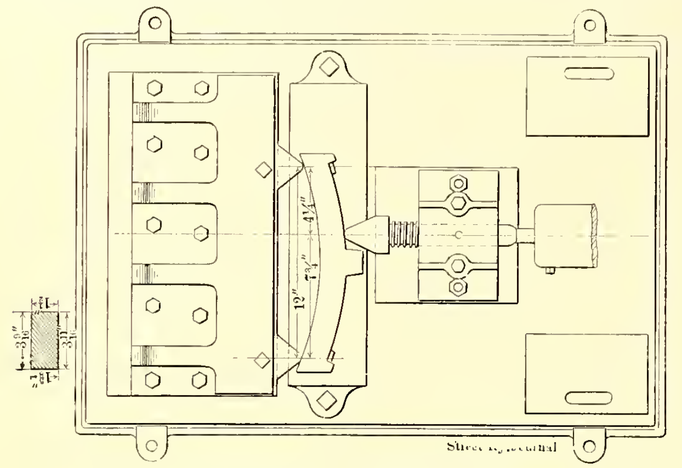


FIG. 1.—PLAN OF MACHINE FOR TESTING BRAKE-SHOES, AND SECTION OF SHOE

As shown in Fig. 2, the impact is obtained by swinging a hammer against a plunger, which in turn strikes the brake-shoe on one side of its lug, as illustrated in Fig. 1. The hammer weighs 55 lbs., and swings out from the shoe on a radius of 5 ft. The test shoes are all of the M. C. B. Christie type, without steel backs or other reinforcement. Part of Fig. 1 shows a section taken $1\frac{1}{2}$ ins. either side of the center of the shoe. The length and other dimensions are according to the M. C. B. standard.

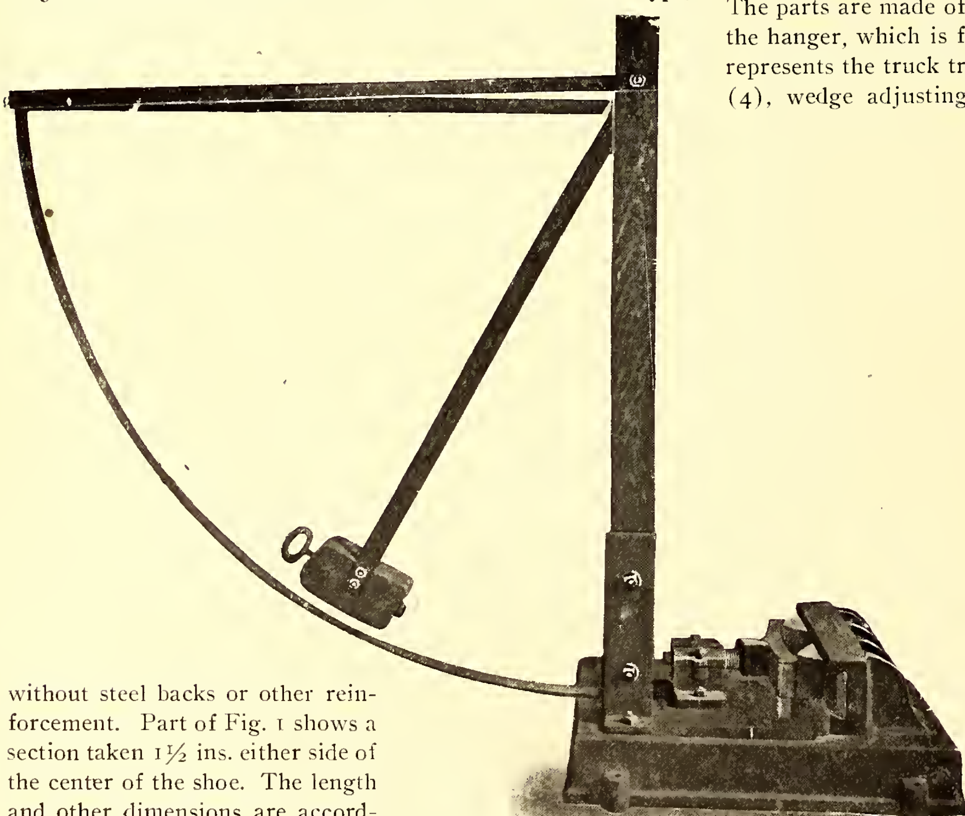


FIG. 2.—VIEW OF THE IMPACT BRAKE-SHOE MACHINE JUST AS THE HAMMER HAS BEGUN ITS SWING

It will be noted that the shoe is placed against the anvil with the knife edges 12 ins. centers. For the first blow the hammer is swung through an arc of 40 degs., the distance being increased 2 degs. at a time until the shoe fails. It is necessary to keep all bolts, set screws and other adjustable parts carefully regulated. The shoe must lie dead on the knife edges, allowing no lost motion between the knife edges and the point of contact of the hammer and plunger. Sample shoes are cast and tested every day on these machines in order that the company may keep its product uniform. It is seldom that any of the material fails to meet specifications—that is, at the 54-deg. point of arc—in fact, the shoes frequently run up to 60 degs. and 70 degs.

A NEW NOISELESS BRAKE HANGER

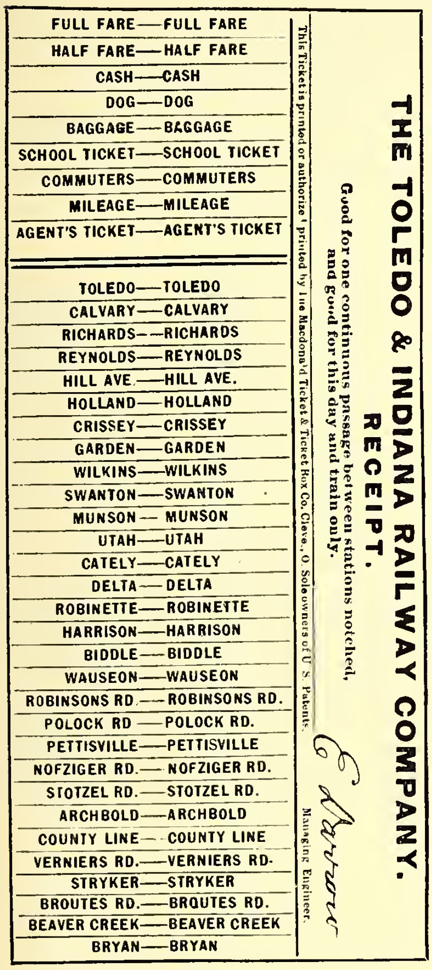
The J. G. Brill Company has recently perfected a new type of brake hanger, which automatically tightens as the bearing parts are worn down, and thus rids the truck of the objectionable noise commonly made by loose hangers. The Brill noiseless brake hanger, as it is called, has been used by a number of railroads for the last six or seven months and has fully demonstrated its efficiency under all conditions, and is now being placed on a large number of trucks. It was invented by G. Martin Brill, president of the company, who has made an exhaustive study of the subject, and believes that this device meets the requirements in every particular.

It will be seen by reference to the illustration that there is no thread to work loose and defeat the purpose of the device, but instead a ball and socket joint with a cap socket, which is always pressed firmly against the ball by a wedge-shaped casting. A pair of coil springs advances the wedge and takes up the slack occasioned by wear. The springs are sufficiently large to insure the proper amount of pressure at all times. The wedge has a movement of $1\frac{1}{2}$ ins., and according to the experience of the various roads up to date, the socket castings will last about two years. The wear, of course, is reduced by the fact that the parts are held closely together at all times. The parts are made of malleable castings, with the exception of the hanger, which is forged. In the illustration presented, (1) represents the truck transom; (2), hanger holder; (3), wedge; (4), wedge adjusting spring, of which there are two; (5), upper socket; (6), lower socket, divided; (7), hanger; (8), brake beams. This hanger is made for all sizes and styles of trucks, and is arranged to connect directly with a special form of brake-shoe holder for trucks which have inside-hung brakes and where space must be economized.

NOISELESS BRAKE HANGER WITH AUTOMATIC TIGHTENER FOR TAKING UP BEARING WEAR

FARE RECEIPTS ON THREE WESTERN INTERURBANS

The Toledo & Indiana Railway Company has adopted the MacDonald "closed system" of cash-fare receipts, and E. Darrow, manager of that company, has made an interesting change in the standard type of receipt usually put out by the MacDonald Ticket & Ticket Box Company, of Cleveland. The device has been described in these columns several times, and it will be remembered that it consists of a closed box with a pad of tickets attached and notchers moving up and down on the frame of the box which cut notches in the receipt. The usual receipt has been for cash fares only, and the receipt contains the names of the towns and the amount paid. Mr. Darrow has dispensed with the plan of showing the amount paid, as this in reality is superfluous, because the distance traveled gives sufficient indication to the auditor as to the amount paid. In place of this, the Toledo & Indiana ticket contains several classifications of fares, as indicated in the illustration herewith. One of these receipts is therefore issued to every passenger, no matter what form of transportation is tendered to the conductor. The plan gives an excellent check, as the number of stubs turned in must correspond with the number of passengers carried, and it is possible to tell between what points each passenger travels.



FULL FARE—FULL FARE
HALF FARE—HALF FARE
CASH—CASH
DOG—DOG
BAGGAGE—BAGGAGE
SCHOOL TICKET—SCHOOL TICKET
COMMUTERS—COMMUTERS
MILEAGE—MILEAGE
AGENT'S TICKET—AGENT'S TICKET

TOLEDO—TOLEDO
CALVARY—CALVARY
RICHARDS—RICHARDS
REYNOLDS—REYNOLDS
HILL AVE.—HILL AVE.
HOLLAND—HOLLAND
CRISSEY—CRISSEY
GARDEN—GARDEN
WILKINS—WILKINS
SWANTON—SWANTON
MUNSON—MUNSON
UTAH—UTAH
CATELY—CATELY
DELTA—DELTA
ROBINETTE—ROBINETTE
HARRISON—HARRISON
BIDDLE—BIDDLE
WAUSEON—WAUSEON
ROBINSONS RD.—ROBINSONS RD.
POLOCK RD.—POLOCK RD.
PETTISVILLE—PETTISVILLE
NOFZIGER RD.—NOFZIGER RD.
STOTZEL RD.—STOTZEL RD.
ARCHBOLD—ARCHBOLD
COUNTY LINE—COUNTY LINE
VERNIERS RD.—VERNIERS RD.
STRYKER—STRYKER
BROUTES RD.—BROUTES RD.
BEAVER CREEK—BEAVER CREEK
BRYAN—BRYAN

This Ticket is printed for authorize'd printed by the Macdona'd Ticket & Ticket Box Co. Cleve., O. Sole owners of U. S. Patents.

THE TOLEDO & INDIANA RAILWAY COMPANY.
RECEIPT.
Good for one continuous passage between stations notched, and good for this day and train only.

E. Darrow
Managing Engineer.

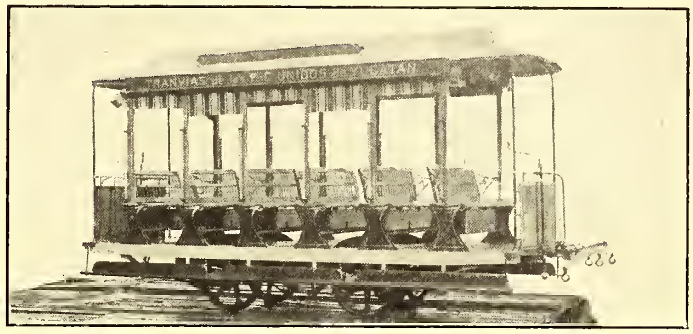
FARE RECEIPT TICKET USED BY THE TOLEDO & INDIANA RAILWAY CO.

The Jackson & Battle Creek Traction Company is using the MacDonald cash-fare receipt in connection with the Ohmer register, and the two systems give a double check on the conductors. Several roads are using the MacDonald device for issuing return-trip tickets; in this case the receipt contains a duplicate coupon, which is good for the return passage. This device is now in use on over thirty prominent interurban roads, and it is proving to be a very simple, reliable and economical method of accounting for cash payments.

The Michigan Traction Company has abolished the zone system of registering fares. Hereafter conductors on the interurban cars will ring only 5-cent cash fares on the register. Tickets will not be registered, neither will cash fares over 5 cents, a duplex ticket being given to the passenger in case his fare is over the minimum amount. The rule recently put into effect allowing stopovers has been abolished, and those desiring stopover tickets will be notified of the rule. Those riding on annual passes, which in a measure correspond to the mileage books of the steam roads, will be asked to sign a sort of receipt for transportation each time their passes are used. These receipts will be signed on the cars and given to the conductors.

AMERICAN CARS FOR YUCATAN

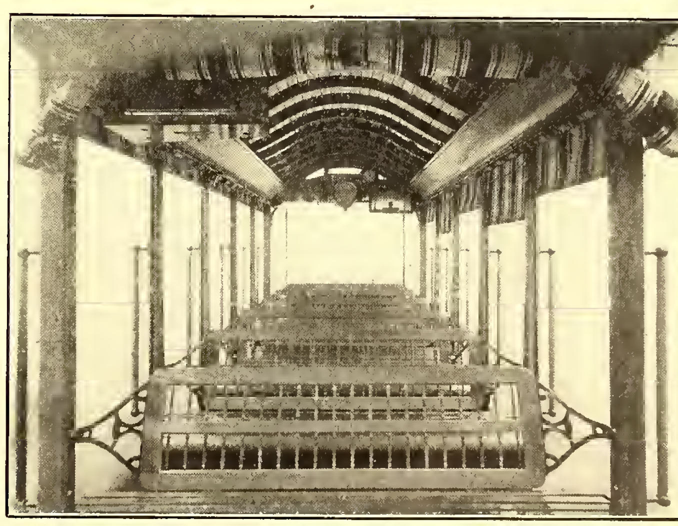
The Tranvias de los F. C. Unidos de Yucatan is one of the few street railways in the peninsula, and is at Merida. The State of Yucatan occupies a large portion of the peninsula of that name, and is more than half the size of Kansas. Its capital is Merida, which is about 50 miles from the northern sea coast, and is connected with the seaport cities of Progreso and Campeachy by steam lines, and also with cities in the interior. The



SIX-BENCH OPEN CAR FOR YUCATAN

streets have recently been paved with brick and asphalt and a system of sewerage installed. The railway company has replaced its rails with 8-in. girders and expects to operate with electricity before long. At present mules are employed for hauling its 200 cars.

The J. G. Brill Company has supplied a large part of its equipment and has recently shipped a lot of six-bench open cars like that shown in the illustrations. Half the equipment consists of closed cars, which are used during the rainy season, which lasts about five months. Formerly operation was rendered difficult on account of the large amount of standing water, as there was no sewerage system to carry it away, but now the city is being modernized, and with the newly paved streets, an impetus has been added which will aid considerably in its development. The company is capitalized at $400,000



AN INTERIOR VIEW OF THE YUCATAN CAR

(Mexican money). It is distinctly a local concern and its capital is held very closely.

The new cars are 17 ft. 11 ins. over the crown pieces, and 5 ft. 1½ ins. wide over the sills; width over the posts at the belt, 6 ft. The illustrations show the general details. It will be noticed that the roof is of carline finish, and is provided with narrow headlinings at the sides, with advertising card moldings at the top and bottom. A clock is placed over the fare register at one end of the car. Brill brake handles, round-corner seat-end panels and other of the builder's specialties are included in the equipment.

CARS FOR THE NEW DIVISION OF THE INTERURBAN RAILWAY COMPANY OF IOWA

The eight cars shown in the illustration recently left the works of the American Car Company, at St. Louis, for Des Moines on their own wheels. These cars are for use on the division just completed of the Interurban Railway Company's system which has Des Moines as its operating center. The new line is known as the Beaver Valley division, and extends to Perry, about 35 miles northwest of Des Moines, and passes through the towns of Herrold, Granger, Moran, Woodward and Gardner. The STREET RAILWAY JOURNAL described the Interurban Railway Company's system in the leading article of the issue of June 20, 1903, under the heading "A Remarkable Iowa Interurban." The remarkable feature to which attention was called was the fact that a large amount of traffic was secured in a territory which at first inspection would seem to be so sparsely populated as to make possible no adequate returns on an investment in an interurban line. The reason given was that, although the population was comparatively small, the exceedingly fertile soil made the district very prosperous. It is stated that the soil of Iowa yields more per acre than any other land in the United States, with the exception of the fruit valleys of California.

ONE OF THE NEW SINGLE-END INTERURBAN CARS RECENTLY FURNISHED TO THE INTERURBAN RAILWAY COMPANY OF IOWA FOR OPERATION ON ITS BEAVER VALLEY DIVISION

The system has been in operation for the past four years and now comprises 35 miles of track, the chief division running to Colfax, about 23 miles to the east of Des Moines. The company was organized under the general railroad laws of the State, and does a considerable amount of freight business, which it handles in standard cars in less than carload lots, interchanging traffic with several of the steam railroads. The freight business on the Colfax division averages from twenty-five to thirty standard carloads per day. There are about ten stock yards along the Colfax and the new Beaver Valley divisions, and the facilities for handling grain are excellent. A large amount of coal is also handled from eight mines of considerable extent which are located on these two divisions. The company is closely allied with the Des Moines City Railway Company. Surveys have been made for extensions to the principal points north and south of the city, and altogether it is expected that 250 miles of lines will be included eventually in the system. Des Moines has a population of about 65,000, and is the capital of the State and its chief railroad center.

The new cars are for operation on the Beaver Valley division, and as there are loops at the terminals, are therefore arranged for operation in one direction. Four of the new cars are combination passenger and smoker, and four are combination passenger and baggage. The general dimensions are: Length over the bumpers, 50 ft.; over the platform, 48 ft. 4 ins.; over the body, 44 ft. 4 ins.; width over all, 8 ft. 10 ins.; length of the passenger compartment, 33 ft. 2 ins., and of the baggage compartment, 11 ft. 2 ins. The bottom framing includes 4¾-in. x 8-in. side sills, with 8-in. channels; the center and intermediate sills are 4¾ ins. x 6 ins., with 6-in. I-beams, and the end sills are 5¼ ins. x 6 ins.; thickness of corner posts, 3¾ ins., and side posts, 2¼ ins. The alternate posts are double. The motorman's compartment is placed in one front corner of the baggage room, and has a maximum length of 5 ft. 6 ins. and width of 2 ft. 10⅛ ins. All of the windows are furnished with storm sashes.

The interiors of the cars are finished in golden oak, neatly carved and inlaid, and the ceilings are of the semi-Empire style, tinted light green and decorated in gold. The high back leather upholstered seats, which are shown in the accompanying view of the interior, are of the Brill manufacture. Other Brill specialties with which the cars are equipped include platform gongs, signal bells and angle-iron bumpers. The cars are mounted on the Brill No. 27-E-2 type of high-speed truck. The trucks have 6-ft. wheel base, 35-in. steel-tired wheels and 6-in. axles. Four motors of 75-hp each are used per car.

INTERIOR OF ONE OF THE INTERURBAN RAILWAY COMPANY'S NEW CARS

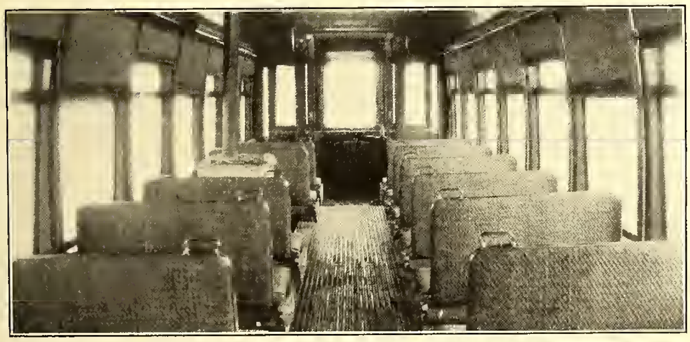
EIGHT CARS FOR THE INTERURBAN RAILWAY COMPANY OF IOWA LEAVING THE CAR SHOPS AT ST. LOUIS ON THEIR OWN WHEELS

THE TOLEDO RAILWAYS & LIGHT COMPANY'S NEW CARS

Within the last few weeks the Toledo Railways & Light Company has put in operation ten new cars of the Brill grooveless-post, semi-convertible type, built by the G. C. Kuhlman Car Company, of Cleveland. This makes a total of 274 cars now operated by the company. This company operates all of the electric lines in the city of Toledo and controls practically all the electric lighting and power business and the underground conduits. The railway system includes 107 miles of track, which embraces sixteen different routes. Last year storage batteries were installed for the lighting plant and also for railway use, the former consisting of 296 cells of fifty-one plates each, and the latter of 264 cells of forty-one plates each. An extension to the power house has been commenced which will have an additional 125-ft. stack. When completed it will contain two 3000-kw steam turbines, direct connected to alternating generators; two 1000-kw rotary converters; one 1000-kw motor-generator set, and four 700-hp boilers. Two substations are soon to be built, in each of which will be installed two 500-kw rotary converters and accessories. When these additions are made, the capacity of the station will be 15,000 kw.

VESTIBULED SINGLE-TRUCK CAR FOR TOLEDO

The railway company has used cars built by the Kuhlman Company for a number of years, and has also a considerable number of double-truck cars of the Brill semi-convertible type. The new cars are 20 ft. 8 ins. long over the bodies and 30 ft. 1 in. over the vestibule sheathing; width over sills, 7 ft. 8½ ins., and over posts at belt, 8 ft. The distance from the center to the center of the side posts is 2 ft. 5 ins.; height from the floor to the ceiling, 8 ft. 4½ ins.; height from the track to the under side of the sills, 2 ft. 2⅝ ins.; height from the under side of the sills over the trolley board, 8 ft. 11½ ins.; height from the track to the platform step, 14¾ ins.; from the step to the platform, 12 ins., and from the platform to the car floor, 7⅜ ins. The side sills are 3⅝ ins. x 5 ins.; end sills, 3½ ins. x 8⅜ ins.; sill plates, 15 ins. x ⅜ in.; thickness of corner posts, 3⅝ ins., and side posts, 2¾ ins. The interiors are finished in cherry, with birch veneer ceilings, neatly decorated. The seats, which are of Brill manufacture, are 35 ins. long, and because the pockets for the window sashes are in the roof instead of in the side walls, the seat ends are placed between the posts and against the side lining, leaving the aisle 22 ins. wide. The cars are mounted on single trucks of the Brill No. 21-E type, which have a wheel base of 7 ft. 6 ins., and the wheels are 33 ins. in diameter. The weight of a car and truck, without motors, is 17,900 lbs.



INTERIOR OF THE TOLEDO SEMI-CONVERTIBLE CAR

TESTING LABORATORY IN BUFFALO

A physical and chemical laboratory has been established in Buffalo under the name of "Buffalo Testing Laboratory," and will be located at the plant of the Buffalo Foundry Company, although entirely independent of that concern. The laboratory will have facilities for the inspection and testing of steel rails, structural steel and all metals, as well as for the analysis and test of cements and other building material. Arrangements have also been made for carrying out any electrical tests which may be required by customers.

The organization has an excellent backing and personnel. The president is George A. Ricker, one of the prominent civil and electrical engineers of Buffalo and the builder of the Niagara Gorge Railroad. The vice-president is Nathaniel W. Shed, who has had an extended experience as metallurgist with the Nashua Iron & Steel Company, at Nashua, N. H., and the Carnegie Homestead Works. Mr. Shed was also for several years professor of metallurgy at the Pennsylvania State College, and is now chemist and metallurgist of the Buffalo Foundry Company. The manager of the inspection bureau is M. E. Biggan, who for the past few years has been personal representative at Buffalo of Dr. P. H. Dudley in inspecting rails of the Lackawanna Steel Plant for the New York Central Railroad. For a number of years he has also inspected all the rails rolled in Buffalo for the Lehigh Valley and the Delaware, Lackawanna & Western Railroads. Mr. Biggan was formerly superintendent of the rail finishing department of the Maryland Steel Company, and was afterward connected for ten years with R. W. Hunt & Company, of Pittsburg.

In spite of the recent industrial development of Buffalo and its prominent position as a center for the production of steel rails, it has not been provided up to this time with a commercial laboratory and inspection bureau of this kind, and the officers of the new company believe for this reason that an excellent business should result. The office of the Buffalo Testing Laboratory is at 702 Ellicott Square, Buffalo.

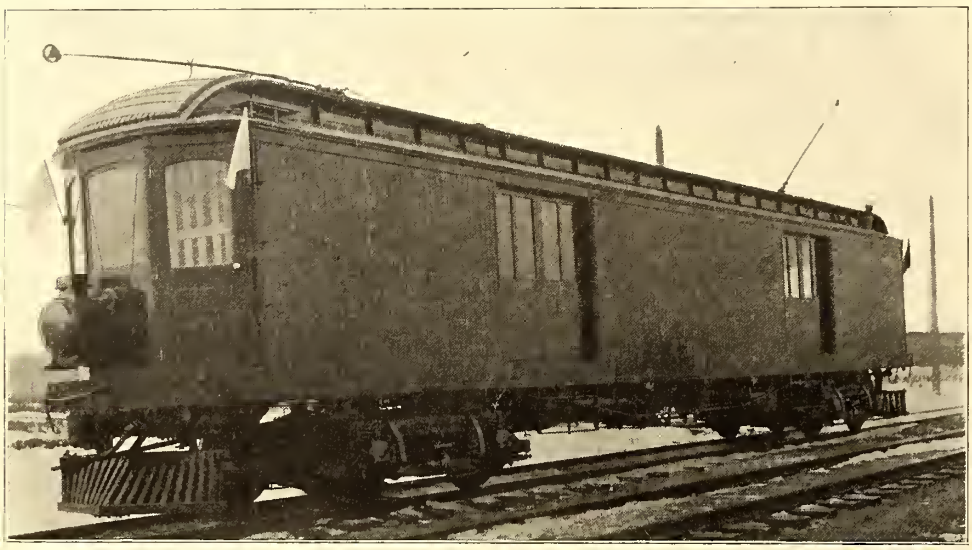
CONSOLIDATION OF SPOKANE RAILWAYS

Jay P. Graves and associates, of Spokane, Wash., have formed the Inland Empire Railway Company, with a capital of $20,000,000. It is understood that the prime purpose of the corporation is to consolidate the present electric railways of the Graves group. The new corporation, which will have an authorized issue of $10,000,000 in common stock and an equal amount in preferred stock, is organized by Jay P. Graves, president of the Spokane & Inland Company; F. A. Blackwell and Waldo G. Paine, of the Coeur d'Alene & Spokane Railway Company; F. Lewis Clark and Aaron Kuhn, of the Spokane Traction Company and of the Spokane & Inland Company; F. A. Blackwell and Waldo G. Paine, of the Spokane Terminal Company. Graves and Blackwell are financially connected with all of the various companies.

The Camden & Trenton Railway, which is controlled by the Trenton & New Brunswick Railroad, now has tickets on sale between Trenton and Camden, N. J., at the rate of 40 cents single or 75 cents excursion fare. The distance each way is about 36 miles. The company also has the largest and finest waiting room in the State at 12 South Warren Street, Trenton, where one of the largest storerooms has been converted into a waiting room and ticket office. Instead of the ordinary seats, there are plenty of chairs, including rockers. In order to lend to the attractiveness of the place, the front windows are decorated with potted plants and ferns.

HEAVY EXPRESS CAR USED BY THE UTICA & MOHAWK VALLEY RAILWAY COMPANY

Early in 1905 the Utica & Mohawk Valley Railway Company placed in service what is probably the largest and heaviest baggage and express car ever built for electric railway work. In designing the car to handle the regular baggage, freight and express service of the company, advantage was also taken to try out an unusually heavy type of electrical equipment, and it is understood the experience gained with this car is being



AN EXTERIOR VIEW OF THE UTICA & MOHAWK EXPRESS CAR

used to good advantage in deciding upon the equipment to be adopted for passenger service on the electrified section of the West Shore Railroad from Utica west to Syracuse, upon which work is in progress.

The express car is 56 ft. over the crown pieces and 8 ft. wide over sheathing. The side sills are of long leaf yellow pine, 5¾ ins. x 7⅞ ins., with 8-in. x ¾-in. sill plates. The cross joists are 4½ ins. x 5½ ins. A slotted partition with door

VIEW UNDER UTICA & MOHAWK EXPRESS CAR, SHOWING MULTIPLE-UNIT CONTROL AND STRAIGHT AND AUTOMATIC AIR-BRAKE APPARATUS

INTERIOR OF EXPRESS CAR, UTICA & MOHAWK VALLEY RAILWAY

forms a motorman's compartment at each end. As will be noticed from the illustrations, there are two double sliding doors on each side of the car, and at the diagonally opposite corners there are smaller doors which swing outwardly, the platforms at these corners being cut away sharply along the door sill to the side of the car instead of making the usual curve. This arrangement of side and end doors greatly facilitates the loading and unloading of bulky freight and express matter, and also permits the carrying of long material as rails or poles. The carrying capacity is 20 tons.

The car can be used as a locomotive for hauling purposes, and is fitted with radial draw-bars for pulling electric cars, and also with heavy M. C. B. couplers for hauling steam railroad freight cars.

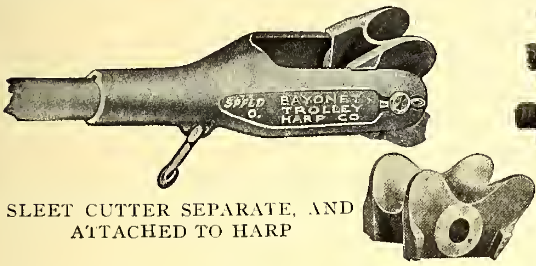
The electrical equipment comprises four Westinghouse No. 85 motors, rated at 75-hp each, giving an aggregate motor capacity of 300 hp. The car is equipped with Westinghouse electro-pneumatic multiple-unit control, and is fitted with both straight and automatic air brakes. The leads, motor wiring and all electrical circuits, with the exception of the low-voltage leads from the storage battery used in connection with the turret control, are in oak molding with four conduits, covered with a capping to correspond, and the turns are all square turns. The low-voltage circuits from the battery are placed in iron pipes.

The body of the car was built at the works of the J. G. Brill Company, and it is mounted on special Brill high-speed No. 27-E-3 trucks. The trucks each have a wheel base of 6 ft. 6 ins. The wheels are steel-tired and 36 ins. in diameter, and the axles are 6 ins. in diameter. The weight of body and trucks without motors is 51,060 lbs. The car has been in regular operation for about one year, and has frequently been run at speeds as high as 1 mile in 58 seconds.

The Springfield, Troy & Piqua Traction Company, of Springfield, Ohio, is building in its own shops five standard freight cars. Each car is 34 ft. long, has a capacity of 40,000 lbs. and will be hauled as a trailer by the company's regular express cars. The company is working up a very large freight business and is interlining with a number of the electric interurban railways in Western Ohio.

A NEW SLEET CUTTER

A new and very simply designed detachable sleet cutter has just been added to the saving devices made by the Bayonet Trolley Harp Company, of Springfield, Ohio. The brass cutter proper resembles very much the wings of a large butterfly, and is used in combination with the Bayonet detachable harp head, fitting in the head in place of the wheel and requiring no contact washers or springs. The cutter block is so designed and closely fit in the head that the contact and, consequently, the conductivity is greater than on any other device of its class. This cutter block, being reversible, affords double service, as when one cutting edge wears out, the other can be made to take its place. In fact, it is claimed that when this cutter wears out, nothing is left but the hole where the axle goes through.

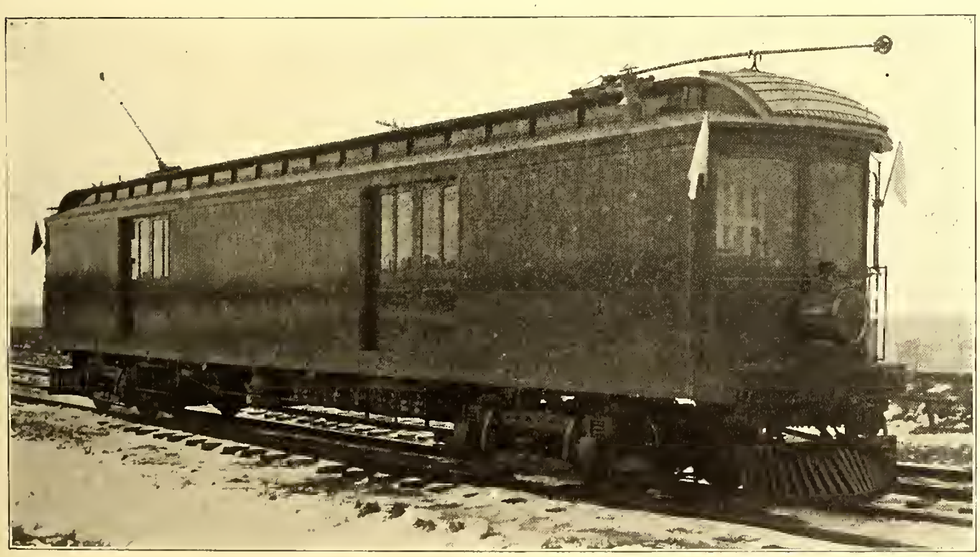


SLEET CUTTER SEPARATE, AND ATTACHED TO HARP

Another very important advantage claimed for this cutter is its very light weight. While most sleet cutters add from 1 lb. to 2 lbs., this cutter reduces the weight at the end of the pole from 2 lbs. to 3 lbs., thus increasing the tension on the wire at a time when it is most needed. This combination cutter and head can be attached to or detached from the harp without the use of any tools in the very short time of 10 seconds. There are no bolts, screws, clamps or other devices to get loose, and when the sleet season is ended, the head can be used with wheel.

COMBINATION INCANDESCENT AND ARC HEADLIGHT

The Trolley Supply Company, of Canton, reports that since it secured control of the Climax combination arc and incandescent headlight from the Globe Electric Manufacturing Company, a few months ago, the headlight has been greatly improved. Special attention has been given to improving the clutch mechanism by which the carbons are fed and to eliminating the "dark spot" which exists in all arc lights. The combination feature is useful in towns where the arc light is not permitted. Here the incandescent circuit only is used. The conductor changes the light by simply changing switch or plug. It is claimed that this has been proven much preferable to the use of a screen or other methods for dimming the light. A good arc is obtained by 1½ amps., and the maximum consumption is 3½ amps. Carbons ⅜ in. in diameter are used, and the reflection of the shadow is almost imperceptible. The company will manufacture this headlight in connection with its other specialties, the Knutson trolley retriever and the American trolley catcher.

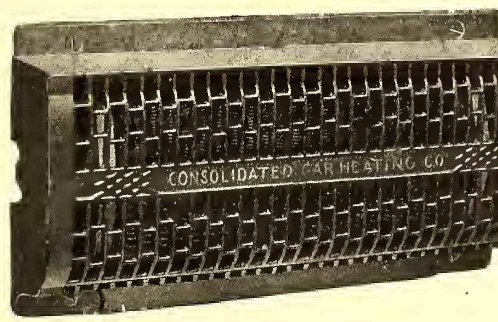


SIDE OF UTICA & MOHAWK EXPRESS CAR. (SEE OPPOSITE PAGE)

ELECTRIC HEATERS FOR NEW YORK CENTRAL RAILROAD

The New York Central Railroad has just closed a contract with the Consolidated Car Heating Company, of New York, for furnishing 180 electric heaters for steel cars for suburban service. There will be thirty-six heaters per car, thirty being of the cross-seat type for use under cross-seats, and six of the truss-plank type for saloons and motormen's cabs. One of the truss-plank heaters will be used in each saloon and two in each of the motormen's cabs.

VIEW OF HEATER HAVING PART OF THE CASE CUT OUT



TRUSS PLANK TYPE ELECTRIC HEATER

The accompanying cuts illustrate the heaters to be furnished on the above contract. The cross-seat heater is a new type of double-coil heater, having but one porcelain spindle with a double groove, on which are wound two coils, and all lead wires are brought out of the heater at one end. The upper illustration, with a section of the case cut out, shows the arrangement of the coils and spacing between same, which allows the freest possible circulation of air. There will be 4212 ft. of wire used in the heater coils in each car equipment, or 144 miles of wire in the 180 equipments. Each equipment will be arranged for four graduations of heat. This company reports the sale of 51,815 electric heaters for use in 4259 cars during the year 1905.

The American Engineering Company, of Indianapolis, Ind., is preparing a new map of the electric interurban railways of Indiana. The map will measure 2 ft. x 3 ft., and will show both the operating lines and those under actual construction.

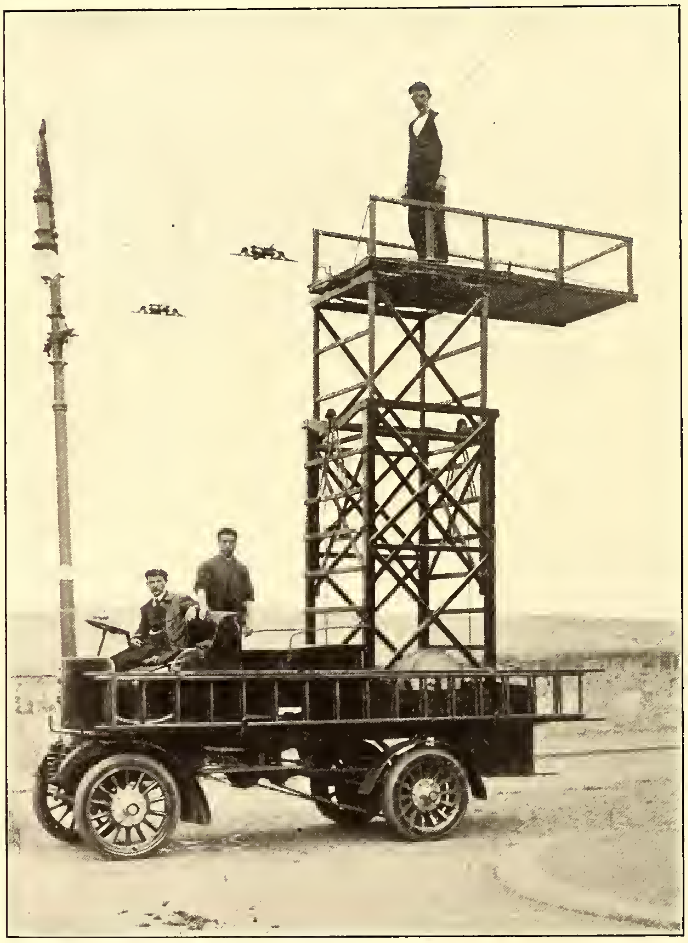
ELEVATED BRAKE-SHOE PRACTICE IN CHICAGO

The Northwestern Elevated Railroad, Chicago, is using on motor trucks an M. C. B. flange brake-shoe with a steel back and chilled ends. The original weight of the shoe is 54½ lbs., and they are stopped at 16 lbs. with a loss in weight of 38½ lbs. These shoes give a car mileage of from 8000 car-miles to 9000 car-miles.

On the trail trucks the company uses a plain brake-shoe—that is, one without a flange. These also have a steel back and chilled ends. When put on, they weigh 22 lbs., and are worn to 6 lbs. A mileage of from 12,000 car-miles to 15,000 car-miles is obtained.

TOWER WAGON FOR GLASGOW

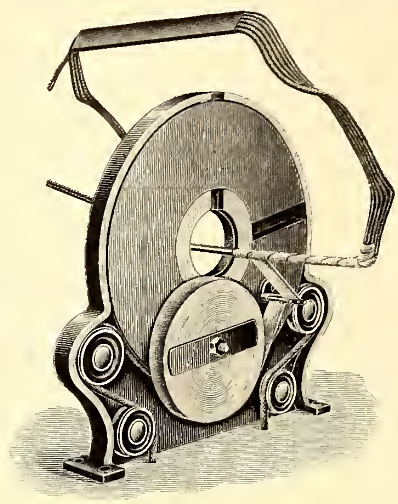
An interesting example of the method adopted by a number of tramway systems in Great Britain to enable repairs to be made quickly without depending upon line cars or horses is shown in the accompanying illustration, which is a view of the gasoline tower wagon built for the Glasgow corporation tramways by the New Arrol-Johnston Car Company, Ltd., of Paisley, Eng. The type of body used for this car, of course, is evident from the illustration, and in this regard it only remains to say that it is constructed in the same substantial manner as this firm's standard motor cars. The tower wagon, however, is equipped with tool and material lockers, a drum for conductor and other wire, and many other fittings suitable for repair work. The gasoline motor used is of 12-hp capacity, and is of the two-cylinder horizontal-balanced type, running at 800 r. p. m. The gearing provides for two or four speeds forward and one reverse speed. Renold "silent" chains connect with the driving axles of the vehicle.



THE GLASGOW TOWER WAGON IN SERVICE

ARMATURE COIL TAPING MACHINE

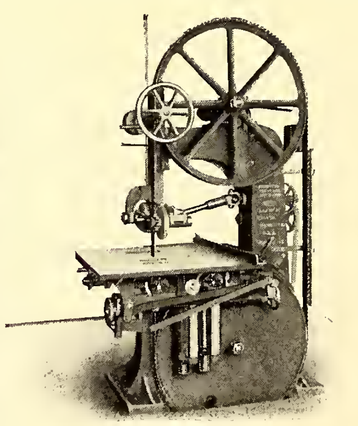
The armature coil taping machine shown in the accompanying illustrations is one of the numerous devices designed and built by the Frank Ridlon Company, of Boston, Mass., to save time and money in electric railway shops. When in use the machine is bolted to a bench and furnished complete with a treadle fastened to the floor. Bronze is used for the working parts of this taper. Any speed can be obtained, according to the pressure put upon the treadle. The tape is fed through rolls, giving any tension that may be desired. The machine is very compactly constructed, as is shown by the following principal dimensions: Height, 11½ ins.; width, 12½ ins.; thickness, 2½ ins. The weight is about 15 lbs.



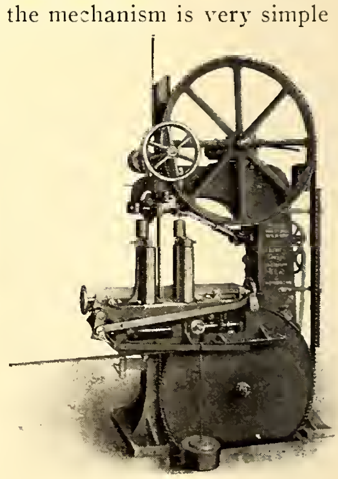
ARMATURE COIL TAPING MACHINE

A COMBINATION RESAW AND RIP-SAW

For crowded shops or where there is not enough ripping and resawing to keep separate machines busy, the J. A. Fay & Egan Company, of Cincinnati, Ohio, makes a combination rip and resaw to do both kinds of work as good as the separate machines. To those who are now using circular saws, this tool comes as a special boon, because with it the big waste in sawdust from circular saws is abolished and the user obtains the benefits of a band saw. While the combination of these two machines in one is entirely new, the mechanism is very simple and the machine can be changed instantly from rip to resaw by one man.



AS A RIP SAW

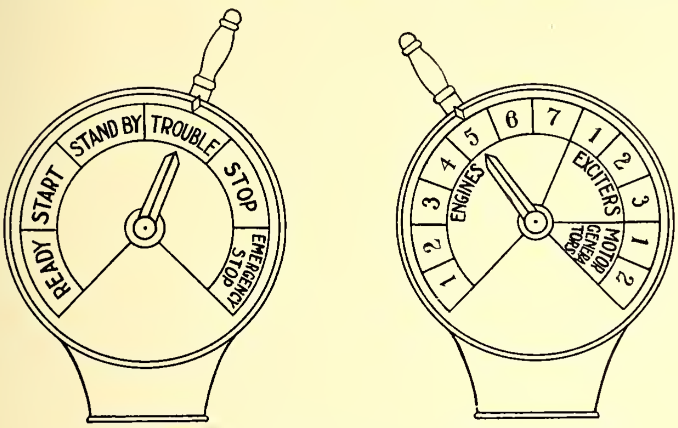


AS A RESAW

The table is 35 ins. x 43 ins., and is mounted on a rocker bearing. The front part carrying the resaw rolls is instantly reversible, and the lower side when reversed forms a clear table for ripping. It rips 24 ins. between saw and fence, 18 ins. under guide, resaws 8 ins. thick. The saw guides are of the company's latest type, and are placed close to the cut of the saw. The feed of the machine is regulated by variable speed frictions, operated by a lever convenient to the operator. For resawing, the feed may be varied from 10 ft. to 50 ft. per minute, and for ripping from 30 ft. to 140 ft. per minute. A special brake mechanism stops the machine instantly.

SIGNALING SYSTEM USED IN PROVIDENCE

While mechanically-operated dial systems are very commonly employed on ships for communicating between the pilot and boiler rooms, it has not yet been fully recognized that they may be used to similar advantage in land stations. In many large power plants of to-day it has been found advisable to isolate the controlling apparatus from the engine room by placing the switchboard in a high gallery from which the switchboard attendant can act as a kind of station pilot. Of course, this plan introduces the necessity of some form of signaling system, as it would be dangerous to depend upon verbal orders, which could be easily misunderstood by the engineers below on account of the usual noises caused by working machinery. The recent adoption of the Cory ship telegraph system in one of the stations of the Philadelphia Rapid Transit



DIALS USED IN CONNECTION WITH SIGNAL SYSTEM

Company, therefore, may lend additional interest to a description of the same system which has been giving very satisfactory service since the opening of the Manchester Street (Providence) station of the Rhode Island Company two years ago.

In the Manchester Street plant the switchboard is placed in a gallery at a considerable height above the engine room. The signaling apparatus consists of two sets of dials mounted on stands, the latter containing two wheels operated by handles and chains. These chains run between both sets of stands. One pair of stands is placed in the switchboard gallery, and the other at a convenient place in the engine room. The markings of the dials for this station, as shown in the accompanying cuts, are arranged for seven engines, three exciters and two motor generators. The following account explains the operation of this system:

When the switchboard attendant observes that the increasing load on the line requires the throwing in of engine No. 4, for instance, he turns the outer handle on his left-hand stand until its pointer reaches the position "Start." The turning of the handle causes the ringing of an alarm gong and sets the inner pointer on the duplicate dial below to the same position. The switchboard attendant also turns the outer handle on the right-hand stand to the position No. 4 in the engine section, which indication is repeated by the inner pointer on the right-hand stand below. The engineer, upon looking at both of his dials, reads the order, "Start No. 4." To signify his obedience to this order, he turns the outer handles on his stands until their pointers are in line with the corresponding inner pointers. This action rings an alarm gong for the attention of the switchboard man, and also causes the inner pointers on the second set of stands to set themselves in line with the pointers on their outside handles, thus signifying to the switchboard attendant that his order is understood.

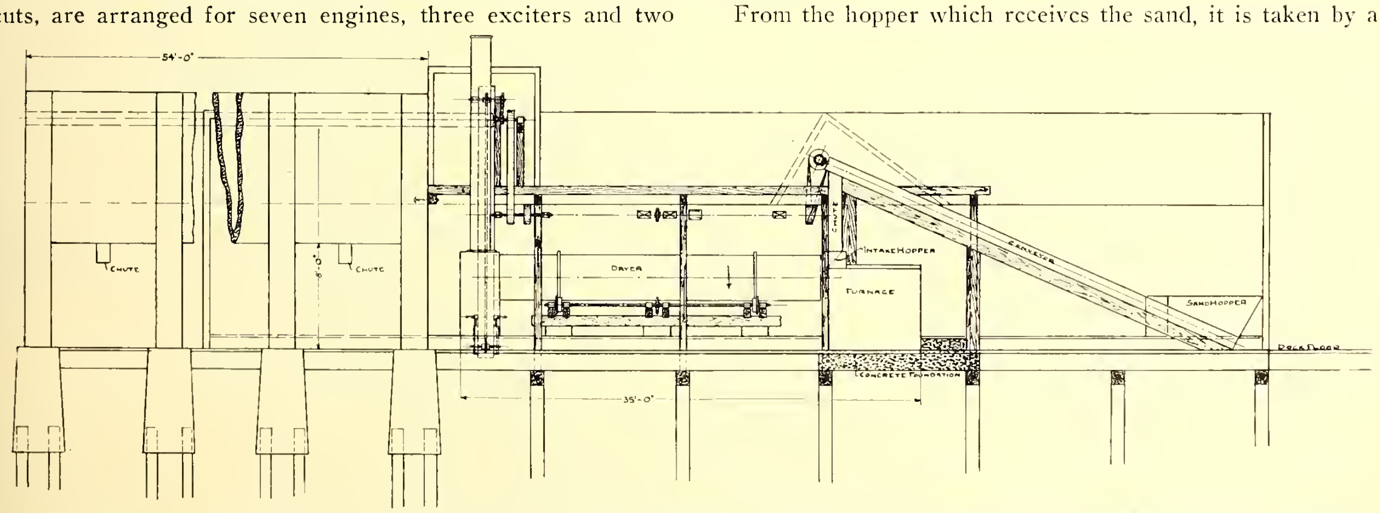
After the engine is up to speed, the engineer signals "Ready," which the switchboard attendant replies to by bringing his pointer to "Ready," and signals "Load" when ready to put the engine on the line. The orders for starting and stopping are given in this way, excepting in case of serious accident to the generating unit requiring it to be shut down at once, when the engineer will signal "Emergency Stop" and at once stop the engine. When the switchboard attendant receives this signal, it is his duty to take the unit off of the line without waiting to reply to the signal.

The instruments used are neatly finished in brass and composition metal, and are furnished with dials 15½ ins. in diameter. They were installed by Charles Cory & Son, of New York.

NEW SAND-DRYING PLANT FOR THE PUBLIC SERVICE CORPORATION OF NEW JERSEY

To be certain of having ready at all times large quantities of well-dried sand, required for its extensive street and interurban railway system, the Public Service Corporation of New Jersey has recently had installed an extensive sand-drying plant by the American Process Company, of New York.

This plant is at Passaic Wharf, near Newark, and only a short distance from the large shops and car houses on the Plank Road line. All sand will be delivered to this location by boat and hoisted directly to the hopper of the sand dryer. The construction of the drying apparatus is shown in detail in the accompanying drawing. It should be noted that a striking feature of the machine is its large capacity, namely, 10 tons per hour.



SIDE ELEVATION OF THE NEW SAND-DRYING PLANT OF THE PUBLIC SERVICE CORPORATION OF NEW JERSEY, AT PASSAIC WHARF, NEWARK

From the hopper which receives the sand, it is taken by an inclined conveyor and dropped through a chute to an intake hopper. From there it is delivered into the drying cylinder. The wet sand and the furnace gases enter the shell at the higher end. The wet material falls to the bottom of the dryer, is caught by a shelf, elevated to almost the highest point of the rotation, and is then showered through the furnace gases. This cycle of operations is repeated until the sand, in a dried condition, is discharged from the lower end of the dryer, where it is caught by a conveyor and elevated to large sand bins, where it is stored until needed. The motive power for the whole arrangement is external to the machine, and can be either electric or steam. A track admits the cars of the electric railway company alongside of the bins where the sand is stored, and that portion needed at other places on the line can thus be conveniently transported.

This plant as designed by the American Process Company represents a considerable saving in labor as compared with methods used where the sand is handled by hand. One man only is required to operate, superintend and look after the firing of the furnace. It is expected that the saving in labor alone will pay for the plant in one year.

SELF-CONTAINED ARMATURE HEADING AND BANDING MACHINE

Among the many economical shop tools made by the American General Engineering Company, of New York, is the one for heading and banding armatures, which is shown in the accompanying illustration. This machine has been adopted as standard by the Public Service Corporation of New Jersey for its Plank Road shops, and is also used in the main shops of the Brooklyn Rapid Transit Company.

While every part of this device is designed to insure economy and reliability in operation and compactness in construction, special attention is directed to its self-contained tension and feeding attachment. This attachment makes it entirely un-

SELF-CONTAINED ARMATURE HEADING AND BANDING MACHINE

necessary for the operator to straddle the wire, and the tension can be easily changed to suit the operator. As the wire is fed automatically from an arm, no handling is necessary, thus avoiding the inconvenience resulting from the use of other machines on which the wire in passing through fibre or other material becomes so heated by friction that it cannot be handled conveniently by the operator. It has been found that the installation of this attachment alone has cut the labor cost from \$3.50 to \$1.50 a day, besides giving neater and quicker work. At this rate the original investment on the machine is returned within a few months, and the later savings are, of course, clear profit.

The speed of this machine is 30 r. p. m. It will take any armatures up to and including 16 ins. in diameter. The principal dimensions are: Length over all, 9 ft. 8½ ins.; extreme width, 3 ft.; height, 4 ft. The weight is approximately 1500 lbs. In addition to this standard machine, the company also builds a heavier one with an increased swing for handling the large armatures used in motors for heavy interurban and elevated railway service.

A NEW AUTOMATIC TRACK SWITCH

Automatic track switches or point controllers are coming into general favor in England since they have been found both economical and reliable in service under the milder climatic conditions of that country. The type described in this article is known as Parr's automatic point controller, and it is a product of Hadfield's Steel Foundry Company, Ltd., of Shef-

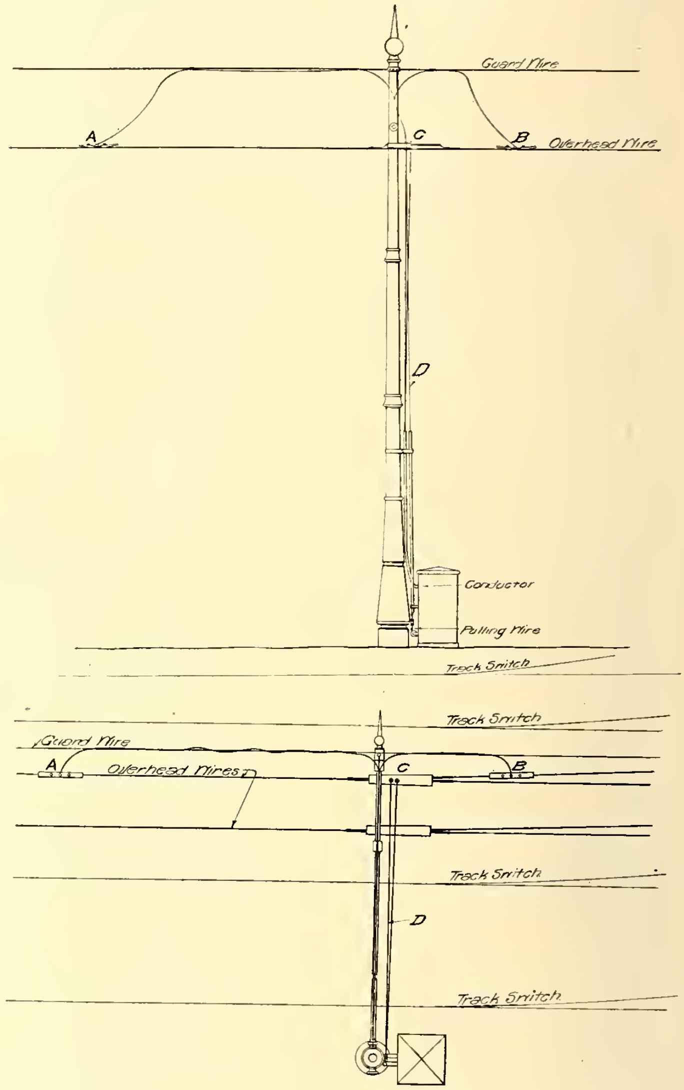


FIG. 1.—DIAGRAMS SHOWING ARRANGEMENT OF CONTACTS AND WIRES FOR AUTOMATIC TRACK SWITCH

field, Eng. A number of these automatic switches are already in successful operation on the Leeds, Bradford, Sheffield, Manchester, Halifax and other corporation tramways.

In the accompanying Fig. 1, the points marked *A* and *B* are contacts sweated on the overhead wires. It is not necessary to cut the overhead wires in any way. Where these wires meet they are joined to form one wire, which is carried down the pole to the contact terminal inside the switch box. The point C represents the overhead frog. A supply wire is carried from the ear pieces to the circuit breaker inside the controller box. It passes through the circuit breaker to the supply terminal on the terminal board, so that the electric current is always, as it were, suspended at the supply terminal waiting to be used. The point marked *D* indicates the hauling wire from the overhead frog, which is attached to the lever inside the switch box, to which the switch tongue is also coupled, and by this means the tongue and frog are operated together. The electromagnet is wired to the same terminals as the contact and supply wires.

The method of operation is as follows: Cars wishing to operate the switch pass under the first contact A, with the controller on the first notch; they break contact with the overhead wire and complete the current circuit through the contact, but as soon as the trolley wheel leaves the contact, the current is again taken from the overhead wire. The momentary excitation of the electromagnet, caused by the trolley wheel at contact A, is sufficient to switch the current to the motor and set it in motion. The motor then continues to take its supply until the tongue of the switch has traveled over, upon which the machine automatically cuts off the current.

One terminal of the motor is also earthed, so that when its circuit is on, the current flows through the motor direct from the supply terminal to earth. Immediately the car makes contact at B, exactly the same action occurs as at A, but the motor rotates in the opposite direction and reverses the switch tongue. This reversing of the motor is brought about by a reversing switch, which reverses the current in the motor. When it is not necessary for the switch tongue to be operated, the motorman allows the car to coast through the contact A, with the motor controller "off" altogether.

At Leeds, where the first of these switch controllers was installed, it operates at a junction where cars pass at the minimum rate of 90 an hour for 19½ hours of the day and a maximum of about 100 cars per hour at busy times. Throughout this very severe test it has been operating with only one contact the track and overhead switch points, as well as the illuminated signals. On the very moderate basis that the switches are operated by every second car, this device made 140,400 operations up to July 1 last with no perceptible signs of wear on any of the parts.

Only one contact, attached to the electrical conductor, is really needed, thereby saving the automatic switch at the very least 50 per cent of the operations otherwise necessary if there are two contacts. The life of the device, which is many years, is thus greatly extended. Two contacts can, however, just as readily be used, if preferred, entailing no other alterations whatever. There is no chance of the insulation used in the above contact breaking down, owing to the particular arrangement employed.

There is no spark or bump, as the trolley wheel runs under the contact. The lamp current of the car cannot actuate the switching mechanism, while only the first notch of the ordinary car controller is more than sufficient to work it. This device can be "set" so that the driver cannot operate and "take" his points above a certain prearranged car speed. It is unaffected in its action by a variation of 150 volts in 550 volts, but can be made to work equally well at all pressures between 300 volts and 600 volts. Damp has no injurious effect on the controller; the street box containing one of these machines on the Leeds City Tramways (being undrained) has at intervals been full of water up to the road level for some weeks past.

Switchmen, of course, are entirely unnecessary, and the wages thus saved pay for this machine in less than one year, after which the cost of operating the point is nothing. It should be noted that this automatic switch is sufficiently powerful to operate the connected movable track and conductor points in conduit tramway systems.

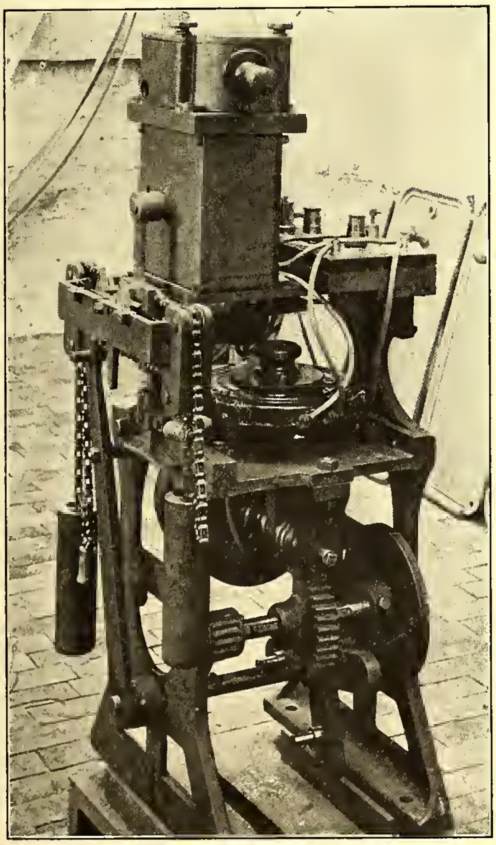


FIG. 2.—VIEW OF OPERATING MECHANISM OF THE AUTOMATIC SWITCH WITH COVER REMOVED

FIG. 3.—VIEW AT A JUNCTION, SHOWING AN INSTALLATION OF AN AUTOMATIC TRACK SWITCH. THE SWITCHING MECHANISM IS IN THE BOX NEXT TO THE POLE ON THE RIGHT

ORGANIZATION OF THE ELECTRIC CABLE COMPANY

The announcement is made that the Electric Cable Company, of Bridgeport, Conn., has been formed to succeed the Magnet Wire Company and the Peerless Electric Company, both of New York. The company is erecting a large model factory in Bridgeport, where it will manufacture magnet wire, field and armature coils and voltax, the new non-rubber insulation which is now on the market for the first time. The New York office will be at 42 Broadway. The officers of the company are: President, Edwin W. Moore; vice-president, Frederick H. Cowles; treasurer, J. Nelson Shreve, and secretary, H. S. Williston. The directors include Alfred Skitt, of New York; John Carstensen, of New York; G. Tracy Rogers, of Binghamton, N. Y.; George C. Edwards, of Bridgeport, Conn.; Russel A. Cowles, of New York; Edwin W. Moore, of New York; Frederick H. Cowles, of New York; J. Nelson Shreve, of New York, and H. S. Williston, of New York.

LONDON LETTER

(*From Our Regular Correspondent.*)

At the invitation of the G. B. Surface Contact Company, a party of journalists connected with the electrical press journeyed a few days ago down to the interesting old city of Lincoln, where this company has recently completed a contract for the Lincoln corporation for the equipment of its small tramway system with the G. B. surface-contact system. The day was a most enjoyable one in every way, Mr. Griffiths, who journeyed down with the party, taking good care of them until Lincoln was reached, where the party was joined by Mr. Bedell. The whole party then boarded one of the electric cars and made a successful trip out to the car sheds at the far end of the route, which is 1¾ miles long. Everyone expressed his entire satisfaction with the way in which the car operated, and great satisfaction was also expressed at the condition of the street, the contact studs being hardly visible, and certainly not protruding above the street to any extent whatever. After an inspection in the car sheds of the under portion of the car, particularly of the flexible skate and the electromagnets for operating the surface-contact system, a return trip was made to Lincoln, the car reaching a speed of 20 m.p.h. to 22 m.p.h., at which speed everything worked as smoothly as possible. A short visit was afterward made to the electric lighting works of the corporation, from which the tramways derive their power, after which a return was made to the Saracen's Head Hotel, where the party was entertained at dinner by Messrs. Griffiths and Bedell. A full description of the system will be found in this issue of the STREET RAILWAY JOURNAL.

It is with regret that we have to record this month the death of two gentlemen who have both been prominently before the public as interested in electric traction enterprises. It is almost unnecessary to mention the name of C. T. Yerkes, who for the past five or six years has been prominently before the public in connection with the various underground railways of London. Other writers in this journal have already borne testimony as to the great position he filled in the world of electric traction, but we cannot refrain in this, our London letter, from at least referring to the great work which he was the means of inaugurating in London. When Mr. Yerkes arrived in London this great city was sadly in need of better transportation facilities. Hours were consumed in getting about from district to district in London where minutes will suffice after the complete scheme of Mr. Yerkes is finished. The first step that Mr. Yerkes took was to associate himself with important English financiers, and then get a controlling interest in the Metropolitan District Railway Company, whose electrification scheme has just been successfully completed. After this followed the purchase of the Baker Street & Waterloo Railway, which enterprise, inaugurated some years previously, had almost fallen through from lack of capital and bad financing. Then followed the Charing Cross, Euston & Hampstead Railway tube, which will give transportation facilities most urgently required, together with the Brompton & Piccadilly and other tube railways. Perhaps another two years, or at least three years, will see the completion of this work, and it is a matter of universal regret that Mr. Yerkes was not spared to see the result of the immense work which he commenced and for which he will be remembered in London for many years to come.

The other death which has occurred in the electric traction circle is that of C. R. Bellamy, of Liverpool. Until quite recently Mr. Bellamy was in the best of health, but he had an unfortunate accident by which he suffered a severely sprained ankle, which necessarily confined him to the house. No one had the slightest idea, however, that anything was seriously the matter with Mr. Bellamy, but unfortunately some complication arose by which one of the arteries became clotted, and ultimately resulted in his very sudden death. Mr. Bellamy was a Londoner, and in his early life was interested chiefly in the development of gas, and as long ago as 1882 received an appointment in the gas department of the Liverpool corporation. In 1884 Mr. Bellamy was appointed superintendent of the lighting department, and in 1895 he was appointed the city lighting engineer, in which capacity he created a great reputation for himself and also for his city, which is generally acknowledged to be the best lighted city in the United Kingdom. It was in 1898 that Mr. Bellamy was brought into the service of the tramways, and it was under his régime that the whole conversion of the tramways was made from horse traction to electric traction. The tramway traffic in Liverpool has been enormous since that time, and the success of the tramways is too well known to be mentioned in detail here. Mr. Bellamy was also popular with the tramway employees and with all the other tramway officials with whom he frequently came in contact, and will be much missed for years to come in all conferences on tramway affairs.

One of the most important appointments which has recently been made in London is that of Sir George Gibb to the chairmanship of the Underground Electric Railways Company, a position made vacant by the death of Mr. Yerkes. It is perhaps not altogether inopportune to mention at this time that great and successful as the work of electrification has been, yet there have been a great many complaints from the traveling public, chiefly in regard to little matters which might just as well be obviated. It would appear as if it had been necessary for some time to have a strong railway man in charge, and no better appointment could possibly have been made than that of Sir George Gibb. He has had twenty-four years of experience in connection with one of the large steam railways, namely, the North Eastern Railway Company, which has also had one of its branch lines electrically converted within the past few years.

The work of constructing the new tramway system between Dundee and Monteith has now been completed, and recently the formal opening ceremony of the new tramway system took place. It will be remembered that J. G. White & Company, of London, secured the contract for the whole of this work, and it has been completed within the short time of six months. This tramway is a suburban one, and will undoubtedly do much to assist in the development of the Dundee suburbs and the neighboring boroughs. The system has been looked forward to for a long time in the district of Dundee and Broughty Ferry, and since the formal opening has been extremely well patronized.

As will be noticed in another column, a description is given of the electrification of the Belfast corporation tramways. This is practically the last of the big tramway systems in this part of the world to be converted from animal traction. There are now left no other cities of anything like similar magnitude which are not already electrically equipped. The whole work, as is well known, has been undertaken by the firm of J. G. White & Company, Ltd., who got the contract for everything, including track, overhead construction, cars, power house and other parts complete. It has been well carried out and to the entire satisfaction of the Belfast corporation officials. If any statistics were still wanting to prove that the electrification of a tramway system is a paying proposition, the statistics of the first few weeks of Belfast would be convincing. For December, 1904, before the electrification, there were 2,321,882 passengers, as against 3,705,872 passengers for December, 1905. Before electrification the receipts amounted in December, 1904, to £11,034 3s. 4d., whereas in December, 1905, the receipts amounted to £15,482 18s. 8½d., showing an increase of 1,383,990 passengers and £4,448 15s. 4½d. in receipts, proving once again that which is well known to all students of the tramway situation, that better traveling facilities and cheaper fares will lead to a tremendously increased traffic and largely increased receipts.

Before this is published the new shallow underground tramway of the London County Council will have been opened for public service. As is very well known now, this underground tramway commences, at the present moment, at the junction of Aldwych and Kingsway. The tramway is at this point about 20 ft. under the street level, but as it gets further north it descends near Holborn to a depth of about 31 ft., so as to avoid the sewers in that thoroughfare. It afterward ascends by a grade of 1 in 10 to a point at the junction of Theobalds Road and Southampton Row, where the system is continued to the Angel on the surface. Trial journeys have already been made in the subway and everything is now in complete working order, and has been duly passed by the Board of Trade. The cars will be of a somewhat different type to those commonly in service in England, as the tunnel has been made with only depth sufficient for a single-deck car, so that all the cars on this route will not have the double deck with which Englishmen are familiar.

Col. Druitt, Board of Trade inspector, has passed the Rochdale section of the Heywood corporation tramways, which couples up practically the whole of the electric tramways system in Lancashire. With this connecting link it will be possible to make a journey by tram from Rochdale to Liverpool, and by the construction of a track in the Todmodren district through connection between Halifax and Liverpool will be obtained.

The Ardrossan committee of Ayr County Road Board has been considering the proposal to lay tramways for Ardrossan and district, and has agreed that the County Council should not consent to the scheme till a satisfactory agreement has been made with the promoters. The committee is of opinion that the tramways would be a great boon to the people in the neighborhood of Stevenston, Saltcoats, Ardrossan and West Kilbride, and it looks upon the scheme as only the forerunner of other tramway schemes which might to some extent affect the different districts in the county.

The interim report of the British Electric Traction Company, Ltd., chronicles the total mileage of tramways, railways and omnibus routes as 439 miles, while the total traffic receipts of all the associated undertakings for the current year are estimated at £1,-

400,000, as compared with £1,264,000 for 1904. Though the company has sold its interests in several undertakings to local authorities and others, upon which the return for 1904 was about £12,000, the directors expect that the aggregate return for the current year upon the company's investments will be maintained.

The Underground Electric Railways Company, of London, has purchased for the Great Northern, Piccadilly & Brompton Railway thirty-six trains of six cars each, all steel construction, and similar to those now being received for the Baker Street & Waterloo Railway. The order has been divided equally between the Hungarian Railway Carriage & Machine Works, Ltd., at Raab, Austria, and Les Ateliers de Construction du Nord de la France, Blanc-Misseron, France.

An order has been placed with the American Car & Foundry Company (English branch), Manchester, for thirty trains of five cars each, all steel construction, for the Charing Cross, Euston & Hampstead Railway.

The Dublin United Tramways Company maintains its dividend at 6 per cent per annum for the fifth consecutive half-year, and again puts £4,000 to reserve, while adding £1,000 to insurance fund and setting aside £2,500 for maintenance in the current six months. A year ago £1,000 was transferred to accident fund, but no provision was made for maintenance. The carry forward is £7,107, against £6,848. The company has a capital of £1,500,000, and has a complete monopoly of the tramway business in the Irish capital. A. C. S.

PARIS LETTER

(From Our Regular Correspondent.)

The managers of the Paris General Omnibus Company are continually protesting against what they consider an injustice of not being permitted to take off from regular service those lines of omnibuses which have become more or less of a burden to the company, by reason of the competition of the Paris Metropolitan lines. It is true that the company has keenly felt the effects of competition of the new lines of the Metropolitan, but during the last few weeks the receipts have shown a considerable increase as compared with those of a year or two ago, and this is traceable to the fact that increased means of traffic create traffic, as has been also noticeable in other large capitals. There are also a number of people who, if they have time, prefer to patronize the trams and buses of the surface companies in preference to the underground tunnels, where the air is at times quite nauseating and probably, to some extent, unhealthy. The Metropolitan Company, apparently, has found no good means of ventilating its tunnels satisfactorily.

The French protectorate of Tunis, which has hitherto not been blessed with traction schemes of any importance, is now receiving attention in France. There are three or four applications for concessions for tramways and light railways, and the journal "Official" has recently contained the usual declaration of public utility of a rather important installation in the town of Tunis and environs.

The Belgian Government, it is reported, has decided to build a high-speed electric line between Ostend and Aix-la-Chapelle, well-known pleasure resorts.

Attention has from time to time been called in this column to the possibilities offered by Italy for the development of electric traction. A French concern with a capital of 5,000,000fr. and debenture capital of 6,000,000fr. has just been formed in Paris for the exploitation in central Italy of various concessions for tramways and light railways, which may be guaranteed by either the government, the provincial or municipal authorities. This is quite a big enterprise, and will doubtless mean renewed activity in Italian traction matters in the near future. M. V.

ANNUAL MEETING OF THE NORTH AMERICAN COMPANY

In accordance with the action taken at the annual meeting of the North American Company on June 21, 1905, at which the by-laws of the company were so amended as to provide that the annual meeting should thereafter be held on the fourth Wednesday in January, instead of the third Wednesday in June each year, the stockholders met on Jan. 24, to receive the report of the president and the treasurer and for the transaction of general business.

The company, as is generally known, controls through the ownership of stock a number of public utilities, the most important of which are the Milwaukee Electric Railway & Light Company, the Laclede Gas Light Company, of St. Louis, and the United Railways, of St. Louis. In his report President Wetmore discusses the general status of the company, referring from time to time at no little length to improvements in hand and to the general condition and prospects of the several companies controlled. Of especial interest is his reference to St. Louis after the fair. He says St. Louis has issued from its World's Fair period not only without depression, but with its business activities greatly stimulated and its confidence in its own destiny greatly enhanced. Prosperity, he says, is equally true of Racine and other cities and towns tributary to the Milwaukee properties of the company. As regards Detroit, he says its manufacturing is unprecedented.

In referring to the plans of the company for the development of the properties, he says that public utilities, if they are to be stable and profitable, should be administered so that they may not only meet the present demands of the communities in which they operate, with service of the highest kind, but also respond immediately to the growth of such communities and their business, however rapid it may be. He then outlines in a general way the improvement being made and those planned to be made to the subsidiary companies. Of interest are his statements regarding the improvements made to the property of the Milwaukee Electric Railway & Light Company. In that city has been erected a new power station which more than doubles the total output of the company three years ago. In addition to this, there has been completed a general office building and terminal station of great utility. This building was so planned that there are a storage room for 100 cars, supply and repair departments, a library, club rooms and many other facilities for the comfort, instruction and amusement of its employees, and a large convention hall and theater. Below is appended a summary of the report of the company for the year ended Dec. 31, 1905, a comparison being made with the previous year:

	1905	1904
Interest	$104,672	$44,835
Dividends	1,157,040	777,153
Other profits	116,901	156,252
Total	$378,613	$978,240
Deduct—		
Salaries, legal, etc.	$93,006	$73,719
Taxes	4,622	4,605
Dividends	1,252,997	840,833
	$1,350,625	$919,157
Balance	$27,988	$59,083

The general balance sheet as of Dec. 31, 1905, compares with that of the previous year as follows:

ASSETS

	1905	1904
Stocks	$29,916,745	$18,738,970
Bonds	541,333	184,258
Loans	1,933,397	339,065
Office and miscellaneous property	4,456	2
Accounts receivable	339,497	43,109
Cash	1,090,212	669,893
Total	$33,825,641	$19,975,298

LIABILITIES

	1905	1904
Capital stock	$29,635,500	$17,000,000
Loans	......	500,000
Dividends	2,274	72,414
Funds of constituent companies	883,004	411,140
Accounts payable	492,631	......
Undivided profits	2,812,232	1,991,744
Total liabilities	$33,825,641	$19,975,298

NEW YORK, NEW HAVEN & HARTFORD RAILROAD GETS MORE LINES

It is authoritatively announced that the Consolidated Railway Company, acting for the New York, New Haven & Hartford Railroad, has purchased the Hartford, Manchester & Rockville Tramway Company, the Stafford Springs line and the rights to complete the Hartford & Worcester Street Railway. This will in no way affect the electrification of the present steam road between Hartford and Rockville, Conn. Work will be continued in electrifying the steam railroad as proposed in the original plan. Some of this work has already been completed on the line. Considerable delay was encountered, owing to the necessity of securing certain rights. These have now been obtained. The purchases which the company has just made give it an undisputed right to build a direct line from Hartford to Worcester. The cities and towns through which the lines of the Consolidated are operated are New Haven, Wallingford, Middletown, Norwich, New London, Willimantic, Killingly, Putnam and Thompson, Conn., and Webster, Oxford, Auburn and Worcester, Mass.

ANOTHER INTERURBAN RAILWAY FOR NORTHERN INDIANA

The State of Indiana, especially the northern portion, is fast becoming an important center for a network of interurban trolley lines which have been and are being built, interconnecting the towns along the Wabash Valley. The Winona Interurban Railway Company, Winona Lake, Ind., is the latest project of the kind to be undertaken.

This company is being promoted and will be controlled by the Winona Assembly, a Presbyterian organization, in the nature of a "Chautauqua" center for Presbyterians and others of that section.

The proposed line will run from Warsaw to Goshen, Ind., about 27 miles, for which the right of way has been acquired and the grading for the entire line completed. The line is located in a portion of two counties which, by action already taken by popular vote, are now collecting taxes appropriate for a subsidy.

The Allis-Chalmers Company, of Milwaukee, will furnish the electrical equipment for the proposed line, including equipments, power house and machinery, through the Electrical Installation Company, of Chicago, in charge of the actual construction and installation. The Winona Assembly organization is understood to have expended over $3,000,000 on grounds and buildings, to which additions are constantly being made. The permanent population at Winona is about 1200, while the transient population during the past summer amounted to over 300,000 visitors. It is expected that the line will be in operation by April.

The equipment specified will consist of two Allis-Chalmers cross-compound condensing engines to drive two 600-kw Allis-Chalmers alternators, 25-cycle; six quadruple 75-hp motor equipments, one 300-kw alternator, three 300-kw rotary converters with transformers, reactance coils, etc., and the usual auxiliary apparatus for sub-station equipment.

TERMS OF NEW YORK TRACTION MERGER OFFICIALLY ANNOUNCED—BELMONT TO BE PRESIDENT

Andrew Freedman, Thomas P. Fowler, Cornelius Vanderbilt, Gardiner M. Lane, Edward J. Berwind and John D. Crimmins, acting as a committee representing the stockholders of the Interborough Rapid Transit Company, the Metropolitan Street Railway Company and the Metropolitan Securities Company, of New York, fixed on Friday, Jan. 26, the exact terms of the merger by which the elevated, subway and surface lines in Manhattan and Bronx Boroughs will be brought under one management. It is required that two-thirds of the outstanding Interborough stock, two-thirds of the outstanding Metropolitan Street Railway stock, and one-half of the outstanding Metropolitan Securities stock be deposited with either August Belmont & Company or the Morton Trust Company. As soon as two-thirds of the required amount of stock is deposited the Interborough-Metropolitan Company may issue, according to the agreement, these securities:

$55,000,000 5 per cent cumulative preferred stock.

$100,000,000 common stock.

$70,000,000 4½ per cent collateral trust gold bonds.

Upon its issue all the common stock will be deposited under a voting trust agreement for a term of years. The voting trustees are August Belmont, Thomas F. Ryan, Cornelius Vanderbilt, Peter A. B. Widener and Walter G. Oakman. This voting trust will come to an end only when the trustees so determine.

The new securities will be exchanged for the old on the following basis:

For each share of stock of the Interborough Rapid Transit Company deposited under the call for deposit, (1) $200 face amount of collateral trust bonds, (2) $99 par amount of common stock (trust certificates).

For each share of stock of the Metropolitan Securities Company ($75 paid in) deposited under the call for deposit, $93.50 par amount of common stock (trust certificates).

For each share of stock of the Metropolitan Street Railway Company, (1) $100 par amount of preferred stock, and (2) $55 par amount of common stock (trust certificates).

The preferred stock will be entitled to preferential dividends from April 1, 1906, at the rate of 5 per cent a year, payable quarterly; it will be preferred also as to capital. The collateral trust bonds will be secured, under an agreement with the Windsor Trust Company as trustee, by the pledge and deposit of all the shares of the Interborough Rapid Transit capital stock which may be acquired by the new company. They will be issued only against this deposit and pledge, at the rate of $1,000 in bonds for each five shares of stock deposited and pledged. The bonds will mature April 1, 1956; the interest, at the rate of 4½ per cent, will be payable semi-annually in New York without deduction for any tax which the company may have to pay on the bonds, because of any future State or United States law.

August Belmont & Company subscribe for $3,000,000 of the preferred stock and pay for it, at par, in cash. And according to the agreement (which contemplates the issue by the Interborough-Metropolitan Company of its entire capital stock) August Belmont & Company will receive $8,700,000 common stock; for this the firm agrees to pay into the treasury of the company $2,250,000 in cash, and also to pay all expenses in connection with the organization and in connection with its acquisition of the stock of the three merged companies.

These expenses will include incorporation fees, transfer taxes, bankers' commissions, trust company charges, State taxes of all kinds, and charges and compensation of committee and counsel. Assuming the common stock to be roughly valued at 60, the $8,700,000 common stock would yield, at the present market value, some $5,200,000. With $2,250,000 paid into the treasury in cash, the remaining $2,250,000 is left for expenses and profits.

Walter G. Oakman has been elected president; John B. McDonald, vice-president, and W. H. Barnum treasurer of the Interborough-Metropolitan Company, which is to act as the holding company in the merger. These officers are regarded as temporary, to hold the positions until the details of the organization are completed and the securities of the traction corporations taken over. August Belmont will probably be elected president of the permanent organization.

TUNNEL BIDS IN BOSTON

In about a month the Boston Transit Commission will invite bids for the construction of the section of the Washington Street tunnel from a point about half-way between State Street and Cornhill to Hanover Street. The section will be about 800 ft long. Rapid progress has been made on the section under State Street, and two of the contractors will probably collect bonuses of $50 per day from the Commission for finishing their work ahead of time. The tunnel is now completed south of Franklin Street, and between Franklin and State Streets the walls are set and the roof laid. The tunnel structure is completed under Newspaper Row, the remaining work at this point being the laying of the roadbed for the lower track, and the extension of a concrete platform over this track from Milk Street to State Street. The underground passage under Water Street, from the Post Office, is also completed, except for the stairway connection at the Post Office end and the tunnel platform.

MEETING OF NEWMAN INTERESTS AT BIRMINGHAM, ALA.

The Newman Properties Association, composed of officials of the various electric railway and lighting properties in the South controlled by the Newman interests of New York City and New Orleans, held a three days' convention at Birmingham, Ala., Jan. 23, 24 and 25. The meeting was attended by about seventy-five delegates, comprising the presidents, managers, superintendents, auditors, claim agents and master mechanics of the different Newman companies, including those at Nashville, Tenn.; Little Rock, Ark.; Knoxville, Tenn.; Memphis, Tenn.; Houston, Tex.; Birmingham, Ala., and representatives from the New York office. The conference was held for the purpose of discussing subjects of interest to all the roads in the association, and making plans for improving and bettering the properties. At the closing session the following officers were elected for the ensuing year: President, Robert Jemison, president of the Birmingham Railway, Light & Power Company; vice-president, C. O. Simpson, general manager of the Little Rock Railway & Light Company, of Little Rock, Ark.; secretary, H. P. Bunn, auditor of the Knoxville Railway & Light Company, of Knoxville, Tenn.

FENDERS IN LOS ANGELES

The Voters' League of Los Angeles announced, after a conference with William E. Dunn, attorney for the Huntington street railway interests in Los Angeles, that it had secured a promise that all the Huntington cars in Los Angeles will be equipped with such fenders as it has been advocating. Mr. Dunn promised for Mr. Huntington compliance with the terms of a certain fender ordinance, excepting so far as it prohibits the hauling of freight through the streets of Los Angeles. Samples of the Eclipse and Consolidated fenders will be sent to Los Angeles for tests. If these tests prove satisfactory, the City Council will be asked to adopt an ordinance covering the specifications. The provisions of the ordinance as to speed at crossings have also been accepted by the street railways. This will limit cars to 4 m.p.h. at crossings in down-town districts, and 8 m.p.m. in the outlying portions of the city.

ORGANIZATION OF TWO FIRE INSURANCE COMPANIES

Announcement has just been made of the organization by the same interests of the American Railway Insurance Company and the Associated Railway Companies' Insurance Company, both of Cleveland, Ohio, especially for the purpose of insuring electric railway and light properties. Each has a capital stock of $200,000 and a surplus of $300,000. The promoters and incorporators are Horace E. Andrews, president of the Cleveland Electric Railway Company; Henry A. Everett, president of the Northern Ohio Traction & Light Company; A. E. Akins, vice-president of the Cleveland Southwestern Traction Company; Warren S. Bicknell, president Lake Shore Electric Railway Company; Chas. W. Wason, president Cleveland, Painesville & Eastern Railway Company; C. G. Goodrich, vice-president Twin City Rapid Transit Company; J. C. Hutchins, president Detroit United Railway Company; John J. Stanley, general manager Cleveland Electric Railway Company; H. J. Davies, secretary of the Cleveland Electric Railway Company and director of the Factory Mutual Insurance Company; T. H. Hogsett, attorney, director of the Factory Mutual Insurance Company, and Henry N. Staats, manager of the Associated Railway & Light Companies' Insurance Inspection & Survey Bureau, which has been organized in connection with the two companies mentioned.

The organization of these two stock companies was the result of the movement organized some time ago by a number of railway companies toward the establishment of a mutual insurance company to insure electric railway and lighting risks. It was considered advisable for the mutual company not to commence business until $20,000,000 in underwriting value had been secured, and to confine the underwriting exclusively to protected risks. As comparatively few risks at the present time can be included in the term "protected," it was decided advisable by Mr. Davies and his associates to organize for present purposes the two stock companies mentioned, and for them to write both protected and unprotected risks until the number of protected risks available in the country would warrant the commencement of business in a mutual way. The new companies believe that by paying no commissions and confining their business to electrical properties they can materially reduce the cost of insurance to operating companies.

In December, 1904, Mr. Davies, secretary of the Cleveland Electric Railway Company, mailed to every street railway company in the United States and Canada a letter, requesting a report of the amount of money paid for fire insurance in each of the past ten years, the amount of losses sustained, and the amount actually recovered from insurance companies. Reports were received from about 420 companies and covering the last ten years. They indicated that the total premiums paid by these companies was $6,049,641; the total losses, $1,971,806, or 32.59 per cent of the premiums paid, and that the amount recovered was $1,673,336, or 27.66 per cent of the premiums paid. According to some figures compiled by J. H. Neal from a number of the New England street railway companies during the last ten years show premiums paid, $1,016,524 and amounts recovered, $239,170, or 23.5 per cent of the premiums.

The new companies will have their headquarters in the Citizens' Building, Cleveland.

A NEW ELECTRIC LINE FOR THE WILLAMETTE VALLEY, OREGON

Although the Willamette Valley, of Oregon, is one of the richest and largest agricultural districts in the United States, its only outlet for freight shipments is by way of the Southern Pacific Railroad. Hitherto it has been impossible to get railroad franchises for a long line in this territory, which would be able to secure a portion of the profitable freight and passenger business to Portland. Recently, however, the Oregon Electric Railway Company was organized to build a single-track line from Salem to Portland, a distance of 50 miles. After overcoming many obstacles, Barstow & Chambers, engineers, of New York and Portland, succeeded in getting all the necessary franchises and rights of way in Salem and all other places along the proposed route excepting Portland, where a franchise application is now pending in the name of a subsidiary company, known as the Willamette Valley Traction Company. The engineering firm mentioned, of which W. S. Barstow is a member, operates for Eastern capitalists all the public service properties in Salem, but the owners of the Salem corporations are in no wise affiliated with the new line, except that some agreement will be reached later as to running rights in that city. The proposed line will extend from Portland south to Salem crossing the Willamette River about 20 miles from Portland. At this point a single-track bridge will be built, capable of carrying 100-ton locomotives. Including the approaches, this bridge will be 1100 ft. long and be 70 ft. above the river at its highest point. The largest part of the construction is to be 70-lb. single track, laid on rock ballast, and running over grades which will not exceed 2 per cent. From these details it will be noted that the line will be capable of carrying heavy trains of freight. It is intended to carry on a regular passenger, freight and express business. The freight business, in fact, will form a very important feature of this line. Where the road enters Portland, connection will be made with the freight yards of the Southern and the Northern Pacific Railroads. The power for operation will be secured from the Portland General Electric Company's power plant at Oregon City. Owing to the fact that the standard frequency of this station is 33 cycles, which is considerably higher than any frequency used on American single-phase railway motors, the engineers of this line have not yet come to a decision as to what type of electrical apparatus to adopt. It is likely, however, that some form of single-phase motor will eventually be accepted.

The present service given by the Southern Pacific to this portion of the Willamette Valley comprises three trains per day, which cover the distance in about three hours. Not only will the new electric line parallel a part of the Southern Pacific, but about 12 miles of branches will be built as feeders to the main line. As an indication of the freight possibilities of this district, it is stated that last year the hop crop in the Willamette Valley amounted to about $10,000,000.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED JAN. 23, 1906

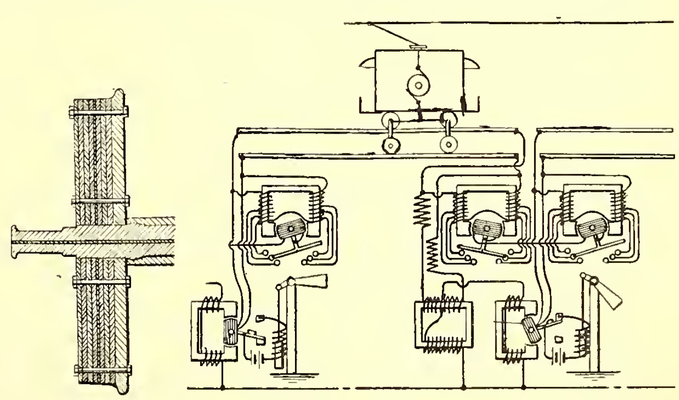
810,395. Hanging Strap for Passenger Vehicles; John S. Collins, New York, N. Y. App. filed March 6, 1905. An advertising frame in the shape of an inverted pyramid is incorporated with a hanging strap.

810,433. Tongue Switch; Ernest B. Prior, Brooklyn, N. Y. App. filed June 29, 1905. A body structure having an integral overhanding portion at the heel extending forward of the tongue-pin, and having an aperture therethrough to permit the insertion and withdrawal of the pin.

810,458. Railroad Spike; Rowland Anderson, Chihuahua, Mex. App. filed May 12, 1905. A railroad spike having a stem or shank adapted to enter a cross-tie beneath the rail thereon, and a lateral extension of said stem forming a shoulder above which the rail is adapted to engage.

810,493. Rail-Joint Chair; Daniel Mersgelder, Cincinnati, and William L. Mersfelder, Norwood, Ohio. App. filed Oct. 25, 1905. A base-plate having ribs on opposite edges to receive between them the base of two adjoining rail ends and wedges adapted to act against the under side of this plate to hold it against the under side of the rail ends.

810,525. Combined Car Axle and Wheel Structure; Lewis P. Fertig, Chicago, Ill. App. filed April 3, 1905. Combines in the construction of car axles and wheels other metals having a different rate and amplitude of vibrations, and in such a manner that the vibrations of the one metal shall neutralize the vibrations of the other to a degree reducing the noise therefrom to a minimum.



PATENTS NO. 810,525 AND 810,687

810,558. Car Seat; Allen E. Ostrander, Paterson, N. J. App. filed July 26, 1905. Provides a car seat of metal and so combined with the car body as to increase the strength thereof and obviate the necessity of bracing.

810,609. Electrofluid Pressure Mechanism for Operating Railroad Appliances; Walter J. Bell, Los Angeles, Cal. App. filed Dec. 1, 1903. A fluid pump located at the various switches serves to continuously maintain pressure in a fluid reservoir. A pair of solenoids have poppet-valve connections for opening and closing the pipes from said reservoir to the cylinder which operates the switch point.

810,674. Vehicle Motor Suspension Mechanism; Frank B. Rae, Detroit, Mich. App. filed Sept. 7, 1905. A plurality of vehicle-supporting journal boxes on the driving axle, a tube connecting two adjacent boxes and enclosing said axle, and a motor having its axle end rotatably mounted upon said tube and its free end yieldingly supported from some other portion of the vehicle.

810,687. System of Automatic Signaling for Electric Railways; Fitzhugh Townsend, New York, N. Y. App. filed Nov. 10, 1905. An inductive bond system in which the bonds for the separate rails have means for compensating for the effect of different currents therein by means of automatically varying the resistance of said bond in inverse proportion to the power current in the rails.

810,705. Block Signal System for Electric Railways; Abram L. Bower, Boyertown, Pa. App. filed Jan. 10, 1903. A turn-out system having insulated track sections at the turn-outs, which make circuits to set the signals alternately by means of a ratchet wheel, which is intermittently stepped around by an electromagnet.

810,762. Fender for Cars and Other Vehicles; George Hipwood, Laconia, N. H. App. filed June 24, 1905. The fender is raised and lowered by a foot-controlled ratchet having a chain connection with the fender.

810,763. Fender for Cars and Other Vehicles; George Hipwood, Laconia, N. H. App. filed June 24, 1905. Details of construction.

810,831. Dust Collector for Cars; George F. Weir, Elkhart, Ind. App. filed June 28, 1905. Provides for the collection of dust thrown up by the car wheels, and consists of a chute laterally arranged outside of the truck wheels and a dust-conducting pipe leading from the chute throughout the entire length of the train to thereby discharge the dust at the rear end thereof.

PERSONAL MENTION

MR. BERNARD CAHN, at one time prominently connected with traction developments in Baltimore and a director of the Baltimore City Passenger Railway Company, is dead.

MR. E. B. KIRK, vice-president and general manager of the Winnebago Traction Company, Oshkosh, Wis., has been elected vice-president of the Northwestern Electrical Association.

MR. J. F. CAMERON has been appointed purchasing agent of the South Chicago City Railway Company. Mr. Cameron has been identified with the company for eleven years, and during the greater portion of this period he has had direct charge of the purchasing and handling of supplies.

MR. H. C. MACKAY, auditor of the Milwaukee Electric Railway & Light Company, has resigned as a member of the committee on the standard classification of accounts of the Street Railway Accountants' Association of America. Mr. F. R. Henry, of the St. Louis Transit Company, has been appointed his successor.

MR. J. F. JOHNSON has resigned as master mechanic of the Fort Smith Light & Traction Company, of Fort Smith, Ark., to engage in business for himself in Fort Smith. He will be succeeded by Mr. Frank Wheeler, of Elkhart, Ind. Mr. Johnson was connected with the Light & Traction Company for fifteen years.

MR. F. J. STOUT, for a number of years general superintendent of the Lake Shore Electric Railway, has been promoted to be general manager of that property. Mr. Stout is a well-known and most successful operating man, and the remarkable gains made by the Lake Shore Electric during the past year were due largely to his efforts.

MR. ROBERT P. LEE, of Pittsfield, Mass., assistant superintendent of the Berkshire Street Railway Company, has been appointed superintendent of the Meriden lines of the Consolidated Street Railway Company. He succeeds Mr. Warren P. Bristol, who resigned to become manager of the Hartford line of the Consolidated Company.

MR. R. W. DAY, former claim agent for the Wilkesbarre & Wyoming Valley Traction Company, has been appointed general manager of the Northern Electric Street Railway Company, which is about to build a line from Scranton to Factoryville, passing through Clark's Summit, Chinchilla, Dalton and La Plume. The line is to be eventually extended to Lake Winola and Tunkhannock.

MR. E. W. OLDS, of Milwaukee, has resigned from the insurance committee of the American Street & Interurban Railway Association. Mr. W. Caryl Ely has appointed in his place Mr. R. B. Stearns, superintendent of the Northwestern Elevated Railway Company, of Chicago. The committee now consists of Mr. H. J. Davies, of Cleveland, and Mr. T. C. Penington and Mr. R. B. Stearns, of Chicago.

MR. GEORGE FLETT, managing director of Dick, Kerr & Company, Ltd., of London and Preston, England, sailed for the East a few days ago. As is well known, the firm of Dick, Kerr & Company constructed the system of tramways in Calcutta, Mandalay, Singapore and Hong Kong, and is just about completing a large system of tramways in Tokil. While Mr. Flett is really going on this trip, which will eventually end by being a tour round the world, for pleasure and health, he will visit all the places en route, stopping at the United States on his way home.

MR. W. A. McWORTER, master mechanic of the Birmingham Railway, Light & Power Company, of Birmingham, Ala., has been made assistant superintendent of the railway department for the company, and he will hereafter fill the two positions. His advancement to executive duties in connection with his mechanical work is a well-merited recognition of his services. Mr. McWorter was for a number of years connected with the mechanical department of the street railway system of Atlanta, Ga., and previous to that was master mechanic of the Savannah Electric Company at Savannah, Ga.

MR. J. R. HARRIGAN, for a number of years general manager of the Columbus, Buckeye Lake & Newark Traction Company and the Columbus, Newark & Zanesville Railway, has resigned to become general manager of the Canton-Akron Railway system, which embraces the Canton-Akron Railway, the Canton-New Philadelphia Railway and the Tuscarawas Traction Company. These properties are owned by Tucker, Anthony & Company, of Boston, who formerly owned the Columbus properties mentioned. Mr. Harrigan was largely instrumental in making the Columbus, Buckeye Lake & Newark Traction Company one of the best paying interurban propositions in the country.

MR DWIGHT W. BLAKESLEE, of New Haven, Conn., well known throughout the East and Central West as a railroad contractor and promoter, was killed by a railroad train on the New York, New Haven & Hartford Railroad near New Haven a few days ago. Mr. Blakeslee was, at the time of the accident, inspecting some work along the road for which he had the contract, and had climbed onto the railroad track from the ditch into which he had gone to give orders. Suddenly he felt the ground give way on which he stood, and in order to save himself from falling back into the excavation pitched forward. In so doing he fell across the railroad in front of an express train.

MR. FREDERICK R. SLATER, who was principal assistant to Mr. L. B. Stillwell while the latter was electrical director of the Interborough Rapid Transit Company, of New York, has resigned from that company and has opened an office as consulting electrical engineer at 100 Broadway, New York. Mr. Slater is a graduate of Cornell University of the class of 1894. After completing his course in electrical and mechanical engineering at that institution he was engaged for a short time in the design of the power station of Cornell University, after which he left Ithaca to assist in the design of the new shops of the Otis Elevator Company. On the outbreak of the recent war with Spain he decided to engage in military service, and served as adjutant in the First Regiment of United States Volunteer Engineers. After the close of the war he joined the forces of the Manhattan Elevated Railway Company, of New York, which was then converting its lines from steam to electricity, and became assistant to the electrical engineer, Mr. Hugh Hazelton. He continued with the Manhattan Company until its electrification was completed, and then accompanied Mr. Stillwell from the Manhattan Company to the work of the electrification of the subway in New York.

MR. W. G. HOVEY has been appointed construction manager of the General Railway Signal Company, in charge of the installation of the new signal system for the electrical zone of the New York Central & Hudson River Railroad Company, the contract for which was recently awarded to the General Railway Signal Company. Mr. Hovey, who is a native of Maine, 45 years of age, has had an extensive experience in signal work, beginning as lineman in the signal department of the New York, New Haven & Hartford Railroad in 1889. A year later he went to the Hall Signal Company as foreman of installation. In 1892 Mr. Hovey went with the Chicago & Northwestern Railroad, as superintendent of signals, and retained this position for eight years, when he was selected by the Taylor Signal Company as superintendent. He was later appointed Eastern agent of this company and afterwards resident manager of the General Railway Signal Company upon the acquisition by the latter company of the business of the Taylor and Pneumatic Signal companies. Mr. Hovey is succeeded as resident manager in New York by Mr. H. M. Sperry, well known for his connection with the Union Switch & Signal Company and the installation of the alternating-current signal system in the rapid transit subway in New York. Mr. Sperry will assume his new duties Feb. 1.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O. Northern Ohio Tr. & Light Co	1 m., Dec. '05	84,985	45,151	39,834	23,411	16,423
	1 " " '04	76,615	41,537	35,078	24,514	10,564
	12 " " '05	963,187	516,390	446,797	276,744	170.053
	12 " " '04	895,731	486,980	408,751	273,664	135,087
AURORA, ILL. Elgin, Aurora & Southern Tr. Co	1 m., Nov. '05	41,123	23,441	17,682	9,333	8,349
	1 " " '04	36,380	21 872	14,508	9,333	5,175
	5 " " '05	224.046	116,923	107,123	46,506	60,617
	5 " " '04	201,586	107,800	93,786	46,506	47,280
BINGHAMTON, N. Y. Binghamton Ry. Co.	1 m., Dec. '05	22,465	11,808	10,657	7,261	3,396
	1 " " '04	20,946	10,414	10,531	7,082	3,450
	6 " " '05	153,536	75,734	77,803	43,389	34,414
	6 " " '04	137,628	69,873	67,756	41,925	25,830
CHICAGO, ILL. Aurora, Elgin & Chicago Ry. Co	1 m., Nov. '05	48,292	28,138	20,153	------	------
	1 " " '04	35,454	19,154	16.300	------	------
	5 " " '05	316,839	156,742	160,096	------	------
	5 " " '04	237,024	116,485	120,539	------	------
Chicago & Milwaukee Elec. R. R. Co	1 m., Dec. '05	66,584	24,199	42,384	------	------
	1 " " '04	39,427	17.520	21,907	------	------
	12 " " '05	594,875	244,552	350,323	------	------
	12 " " '04	464,655	179,038	285,618	------	------
CLEVELAND, O. Cleveland, Painesville & Eastern R.R. Co	1 m., Dec. '05	19,841	*10.144	9,698	6.799	2,899
	1 " " '04	17,093	*10,692	6.401	6,638	†237
	12 " " '05	245,089	*141,270	103,819	80.839	22,989
	12 " " '04	225,751	*136,021	89,730	80,250	9,480
Cleveland & Southwestern Traction Co.	1 m., Dec. '05	47,540	26,548	20,992	------	------
	1 " " '04	37,071	22,435	14,636	------	------
	12 " " '05	543,227	314,254	228,973	------	------
	12 " " '04	475,362	293,615	181,746	------	------
DETROIT, MICH. Detroit United Ry	1 m., Dec. '05	444,346	*242,621	201.725	98,696	103,029
	1 " " '04	392,757	*238 690	154,067	93.619	60,448
	12 " " '05	5,169,638	*3041522	2,128,116	1,113,293	1,014,823
	12 " " '04	4,584,582	*2763092	1,821,490	1,075,786	745,704
EAST ST. LOUIS, ILL. East St. Louis & Suburban Co	1 m., Dec. '05	128,511	57,694	70,817	------	------
	1 " " 04	115,403	45,650	69,753	------	------
	12 " " '05	1,351,576	597,452	754,124	------	------
	12 " " '04	1,363,549	596,157	767,392	------	------
FT. WAYNE, IND. Ft. Wayne & Wabash Valley Tr. Co	1 m., Nov. '05	80,474	46,926	33,548	------	------
	1 " " '04	67,109	43,849	23,260	------	------
	11 " " '05	862,167	530,501	331,666	------	------
	11 " " '04	761,969	491,746	270,223	------	------
FT. WORTH, TEX. Northern Texas Tr. Co	1 m., Nov. '05	66,271	36,247	30,023	9,938	20,086
	1 " " '04	47,634	30,621	17,013	9,100	7,913
	12 " " '05	658,906	387,077	271,829	117,372	154,457
	12 " " '04	551,716	330,244	221,472	107,911	113,560
GALVESTON, TEX. Galveston Electric Co.	1 m., Nov. '05	22,522	13,757	8,765	4,167	4,598
	1 " " '04	19,628	------	------	------	------
	7 " " '05	171,993	103,320	68,673	29,167	39,506
	7 " " '04	161,682	------	------	------	------
HANCOCK, MICH. Houghton County St. Ry. Co	1 m., Nov. '05	15,215	11,067	4,148	3,749	399
	1 " " '04	16.692	10.783	5,909	3,324	2,585
	11 " " '05	150,212	156,503	†6,291	39,870	†46,161
	11 " " '04	182,429	121,920	60,509	37,111	23,398
HOUSTON, TEX. Houston Electric Co.	1 m., Nov. '05	52,236	33,572	18,664	9,049	9,616
	1 " " '04	42,983	26,246	16,738	8,284	8,454
	12 " " '05	509,008	307,211	201,796	105,025	96,771
	12 " " '04	348,785	315,997	32,787	96,176	†63,389
HUDSON, N. Y. Albany & Hudson R. R. Co	1 m., Dec. '05	25,241	*20,018	5,223	------	------
	1 " " '04	22,716	*21,273	1,443	------	------
	12 " " '05	320,281	*253,958	76,323	------	------
	12 " " '04	292,337	*219,029	73,308	------	------
JACKSONVILLE, FLA. Jacksonville Elec. Co.	1 m., Nov. '05	22,423	15,216	7,207	3,391	3,816
	1 " " '04	23,248	14,163	9,085	3,018	6,067
	11 " " '05	282,018	165,775	116,243	34,531	81,712
	11 " " '04	263,929	161,399	102,530	33,784	68,746
MILWAUKEE, WIS. Milwaukee El. Ry. & Lt. Co.	1 m., Dec. '05	400,905	138,565	262,341	83,087	179,254
	1 " " '04	353.307	136,263	217,044	82,072	134.973
	12 " " '05	3,348,696	1,551,463	1,797,233	931,016	866,217
	12 " " '04	3,285,378	1,592,414	1,692,964	916,460	776,505
Milwaukee Lt., Ht. & Tr. Co	1 m., Dec. '05	78,464	19,561	58,903	22,807	36,096
	1 " " '04	68,242	17,102	51,140	17,949	33,191
	12 " " '05	639,128	252,557	386,572	255,314	131,258
	12 " " '04	492,228	216,964	275,264	203,731	71,533
MINNEAPOLIS, MINN. Twin City R. T. Co	1 m., Nov. '05	417,218	190,360	226,859	113,208	113,650
	1 " " '04	354,202	162,704	191,497	97.308	94,189
	11 " " '05	4,320,887	1,961,448	2,359,440	1,113,425	1,246,015
	11 " " '04	3,930,430	1,843,111	2,087,320	1,011,749	1,075,571
MONTREAL, CAN. Montreal St. Ry. Co.	1 m., Dec. '05	236.946	161,995	74,950	22,611	52,340
	1 " " '04	211,283	146,821	64,463	18,475	45,988
	3 " " '05	719,369	457,304	262,066	65,747	196,318
	3 " " '04	638,114	402,307	235,808	56,293	179,515
OAKLAND, CAL. Oakland Traction Consolidated	1 m., Nov. '05	124,131	64.369	59,762	34,610	25,153
	1 " " '04	109.065	56,232	52,833	26,525	26,308
	11 " " '05	1,310,096	673,020	637.076	357,929	279,147
	11 " " '04	1,146,982	598,820	548,162	292,024	256,138
San Francisco, Oakland & San Jose Ry. Co.	1 m., Nov. '05	46 822	21,077	25,745	13,425	12,320
	1 " " '04	41,389	16,259	25,129	11,108	14,021
	11 " " '05	485,964	214 325	271,638	146,415	125,224
	11 " " '04	377,511	163,623	213,887	99,440	114,447
OLEAN, N. Y. Olean St. Ry. Co	1 m., Nov. '05	10,009	5,159	4,850	2,554	2,296
	1 " " '04	8,894	4,611	4,283	2,631	1,651
	5 " " '05	58,609	28,519	30,089	13,282	16,808
	5 " " '04	51,941	25,606	26,334	13,156	13,178
PEEKSKILL, N. Y. Peekskill Lighting & R.R. Co	1 m., Nov. '05	10,125	*5,516	4,609	------	------
	1 " " '04	8,581	*5,477	3,103	------	------
	5 " " '05	56,658	*28,687	27,972	------	------
	5 " " '04	51,187	*27,254	23,933	------	------
PHILADELPHIA, PA. American Rys. Co	1 m., Dec. '05	130,422	------	------	------	------
	1 " " '04	114,429	------	------	------	------
	6 " " '05	848,957	------	------	------	------
	6 " " '04	750,681	------	------	------	------
ROCHESTER, N. Y. Rochester Ry. Co	1 m., Dec. '05	167,905	96,361	71,544	25,998	45,546
	1 " " '04	142,224	75,535	66,689	26,834	39,855
	12 " " '05	1,787.858	973,476	814,383	332,133	482,250
	12 " " '04	1,499,719	824,490	675,228	319,970	355,257
ST. LOUIS, MO. United Railways Co. of St. Louis	1 m., Dec. '05	730,462	361,714	368,748	265,417	103,331
	1 " " '04	685,463	386,437	299,026	240,783	58,243
	12 " " '05	8 460,016	4,414,866	4,045,150	3,291,418	753,732
	12 " " '04	9,977,564	5,263,837	4,713,727	2,933,542	1,780,205
SAN FRANCISCO, CAL. United Railroads of San Francisco	1 m., Nov. '05	604,686	------	------	------	------
	1 " " '04	567,673	------	------	------	------
	11 " " '05	6,430,348	------	------	------	------
	11 " " '04	6,075,112	------	------	------	------
SAVANNAH, GA. Savannah Electric Co.	1 m., Nov. '05	50,420	28,413	22,007	11,155	10,852
	1 " " '04	45,635	26,378	19,257	10,552	8,705
	12 " " '05	580,544	343,357	237,187	127,342	109,845
	12 " " '04	540,833	307,909	232,924	126,024	106,901
SEATTLE, WASH. Seattle Electric Co	1 m., Nov. '05	227 852	147,632	80,220	22,139	58,081
	1 " " '04	200 607	147,972	52,636	24,974	27,662
	12 " " '05	2,538,852	1,668,781	870,071	293,053	577,018
	12 " " '04	2,306,100	1,586,266	719,833	286,500	433,333
SYRACUSE, N. Y. Syracuse R. T. Co	1 m., Nov. '05	82,748	46,591	36,157	20,540	15,618
	1 " " '04	69,998	40,291	29,706	20,337	9,369
	5 " " '05	419.172	231,711	187 461	102.315	85,146
	5 " " '04	361,280	202,933	158,348	101,467	56,881
TERRE HAUTE, IND. Terre Haute Tr. & Lt. Co	1 m., Nov. '05	55,459	33,883	21,576	10 429	11,147
	1 " " '04	49,308	29,171	20,137	9,222	10,916
	12 " " '05	620,768	407,350	213,418	120,652	92,766
	12 " " '04	562,883	370,900	191,982	114,132	77,850
TOLEDO, O. Toledo Rys. & Lt. Co.	1 m., Nov. '05	164,418	*86 389	78,029	42,825	35,204
	1 " " '04	146,759	*77,037	69,722	41,626	28 096
	11 " " '05	1,737,711	*888,296	849,415	467,846	381,569
	11 " " '04	1,586,904	*845,372	741,532	458,181	283,351
YOUNGSTOWN, O. Youngstown-Sharon Ry. & Lt. Co	1 m., Nov. '05	50,440	*24,379	26,061	------	------
	11 " " '05	492,290	*260,762	231,528	------	------

NEWS OF THE WEEK

CONSTRUCTION NOTES

HUNTSVILLE, ALA.—It is understood that, failing to get the Nashville & Huntsville Railroad, the people of Shelbyville and Fayetteville, Tenn., will raise money to build an electric railway to connect the three places. There is a demand for the line, and it would develop a fine agricultural and timber section. There is abundant water power to be had hard by. R. E. Pettus, of Huntsville, is looking into the matter for the Chamber of Commerce of his city.

FORT SMITH, ARK.—The City Council has granted to the Interurban Electric Company an extension of one year in which to begin work, making the third extension since the company was incorporated two years ago. E. B. Miller, of the Commercial Club, has interested Memphis capital in the enterprise. The work is to be commenced within twelve months, and 3 miles are to be completed eight months thereafter. The company has a charter for 12 miles of road within the city limits and right of way through the other cities of the county, the round-trip distance from Fort Smith being about 50 miles.

HARRISON, ARK.—An agreement has been reached between the City Council and Mr. Quigley for an electric light, waterworks and electric railway. It is proposed to construct a line from Harrison to Bergman, the nearest point on the new White River line, 10 miles from this place.

FRESNO, CAL.—The Fresno Traction Company, A. J. Wiskon, manager, has been granted a franchise covering several lines, and the F Street Road will be the first constructed. The company will co-operate with the Southern Pacific Railroad in the construction of a three-tube conduit subway that will cost the traction company about $20,000. New car houses and repair shops both for the railway lines and the San Joaquin Power Company will be erected at Sunnyside.

LOS ANGELES, CAL.—The Pacific Electric Railway is to be extended to Covina over the old Rapid Transit Railway right of way as far as Shorb Station, through Savannah, El Monte, and thence to Covina.

LOS ANGELES, CAL.—"We are preparing to furnish the traveling public a shorter, faster line to Pasadena," said H. E. Huntington to a STREET RAILWAY JOURNAL representative recently, on his departure for a six weeks' business trip to New York. Mr. Huntington referred to work just begun on the line of the old San Gabriel Valley Rapid Transit Company, which will connect with the present Pasadena Short Line of the Pacific Railway Company east of the Los Angeles River, crossing on Aliso Street, continuing by a private right of way to a point east of Eastlake Park, whence a direct line will be run to connect with the present roadway, now under operation. A large force of men is now at work repairing the old roadbed. It is understood that this new line will provide a direct route not only to Pasadena, but to Corina and other foot-hill towns as well.

LOS ANGELES, CAL.—W. D. Larabee, formerly superintendent of the Los Angeles-Pacific Railroad Company, has interested Los Angeles capitalists in a railway project in Northern Oregon. Articles of incorporation have been filed in Portland for the United Railways Company. Among the incorporators are: W. D. Larabee, M. H. French and J. Whyte Evans, of Los Angeles. The company is capitalized at $5,000,000, and proposes to build a railway from Portland to Peak that can be operated either by steam or electricity. A street railway system also will be installed in Portland.

MILL VALLEY, CAL.—The company which operates the Mount Tomalpais Scenic Railway, connecting at this point with the North Shore Electric lines, is rushing work on a 5-mile branch which will terminate in a virgin redwood forest.

NEVADA CITY, CAL.—A new industrial electric railway has been built by the North Star Company. The line is 2½ miles long and connects every department of the Central and North Star mines. It will carry ore from the Central shaft to the North Star mill, and thence to the cyanide plants. In addition to this it will convey iron, ore or any material to any part of the mine. It will take the place of several teams which have been hauling between the two mines, these teams supplanting a traction engine used several years ago. It is estimated that the new method of transportation will effect a saving to the company of several hundred dollars a month. Twenty-five iron and steel cars are being built to hold and carry the ore.

PETALUMA, CAL.—Surveyors have commenced work on the new electric railway which is to run direct from this city to Santa Rosa, avoiding the loss of time involved in the roundabout route by way of Sebastopol. Surveys have been completed as far as Stoney Point, where the new line will make its first change of course. The work is to be rapidly pushed.

REDDING, CAL.—The Shasta County Board of Trade has been notified of the intention of the Boston syndicate promoted by Alonzo Cloaver to construct an electric railway from Redding to Weaverville and thence to the Pacific Coast. The surveys have already been made. The work is to commence as soon as the road of the same company now being built out of Union, Ore., is well under way. Trinity and Shasta Counties will give moral and financial support to the new road here, which will touch great mining and lumbering regions.

SAN FRANCISCO, CAL.—A plan is on foot to create at Inverness, on Tomalos Bay, a large summer resort like Del Monte, at Monterey, and if the plan is carried out it will involve the construction of an electric railway between Inverness and Point Reyer, the nearest railroad station.

SAN BERNARDINO, CAL.—Shipments of material are arriving for the installation of a modern incline railway which is now being constructed to the summit of the mountain range above Arrowhead, Hot Springs, of this county. This incline is to be about 1700 ft. in length, and will have a grade of 45 per cent. Track laying is being completed as fast as possible. The road will resemble the Mount Lowe Railway, and after it has been used for the transportation of freight needed in building the great Arrowhead dam it will be operated as a scenic passenger line, connecting with the proposed electric railway from San Bernardino to the base of the mountains.

SAN JOSE, CAL.—The San Jose & Santa Clara Railroad Company has been granted a franchise for a broad-gage electric railway on Santa Clara and Tenth Streets for a period of fifty years. The railroad company at present has a franchise over the right of way mentioned, but it has only eighteen years to run. Under the new fifty-year franchise extensive improvements will be made, including the making of the tracks broad gage. The road will be newly equipped and cars will be run on a five-minute schedule. Prior to the granting of the franchise many obstacles were placed in the way by opposing railroad interests. Mandamus proceedings to prevent the granting of the franchise are pending at present before the Supreme Court.

STOCKTON, CAL.—Sealed bids will be received up to 8 p. m., Feb. 19, for a franchise to construct and operate an electric railway upon certain streets here. Newton Rutherford is city clerk.

STOCKTON, CAL.—The Stockton Electric Railway Company will soon begin the work of broad-gaging all of its tracks. City Surveyor Tumelty, who was engaged to run the levels for the new tracks, has finished the work on El Dorado, Main and California Streets. He will begin at once the levels on the line reaching from Main Street to the baths on San Joaquin Street.

VALLEJO, CAL.—Sealed bids will be received up to 10 a. m. Feb. 5, at the office of G. G. Halliday, County Clerk, at Fairfield, for the purchase of franchises to construct and operate an electric road upon certain streets, as applied for by Jas. A. Keys and J. W. Hartzell.

HARTFORD, CONN.—The Consolidated Railway Company is about to commence work on two brick sub-stations to be used in operating the new system of trolley cars to be run on the steam road between Hartford and Rockville. The sub-stations are to be built of brick, and one will be located in Buckland, not far from the passenger station, and the other will be located at West Street in Rockville. The power for running the new line will be supplied by the Hartford Electric Light Company, and when it leaves the power station it will be in the form of an alternating current. The contract for the sub-stations was let to the H. Wales Lines Company Dec. 26. The bonding of the rails on the steam road has been completed from Burnside to Manchester, and the work of setting the poles has begun at Burnside and has been carried on a short distance toward Manchester.

MIDDLETOWN, CONN.—It is said on good authority that the Consolidated Street Railway Company is planning to lay a trolley line for some distance along the river and connect it with the main trolley lines now in use in the city. It will be mostly for the purpose of carrying freight. The plans are said to call for an extension of the tracks along Water Street, from the foot of Washington, to Union Street, and thence to the lines of the South Farms Division. This would pass the freight depot and steamboat wharf and would make things very handy for shippers at the South Farms.

WASHINGTON, D. C.—Workmen have been busily engaged for the past week at the Georgetown station and office building of the Capital Traction Company, converting a portion of the second floor of the structure, which has heretofore been used for storage purposes, into an office apartment for the accommodation of the officials of the Great Falls & Old Dominion Railway Company. In addition to this, it is also known that the Great Falls Company is to extend the underground portion of its road to its car house, several hundred yards from the Government's reservation at Roslyn, instead of terminating it at the Virginia end of the Aqueduct bridge, as it is at present provided for. This will necessitate the reconstruction of that portion of the road which extends from the Virginia end of the Aqueduct bridge to the car house, as at present it is built for overhead trolley. The Great Falls & Old Dominion line is now practically complete. No date has been set for the opening of the road.

CHICAGO, ILL.—Amendments to the Mayor's $75,000,000 Mueller ordinance, which was passed by the City Council Jan. 18, are being prepared by attorneys. "There will be some amendments," said the Mayor, "but the method of their introduction will be a question for the attorneys for the city's interests to decide. I am not yet prepared to say anything about the selection of men for trustees under the ordinance passed by the City Council." Before a meeting of the Real Estate Board, held recently, Frank G. Hayne said he did not believe the people would authorize the issue of $75,000,000 worth of Mueller certificates at the polls, and if they did so, he thought purchasers would be difficult to find.

CRAWFORDSVILLE, IND.—The Crawfordsville & Northwestern Traction Company has filed articles of incorporation with the Secretary of State. The capital stock is $100,000. The proposed line is to start at Crawfordsville and pass through Wesley, Waynetown, New Richmond, Wingate, Atteca, Hillsboro, Melott, Aylesworth, Stone Bluff, Newton, Williamsport, Kramer, Carbondale, Judyville and Pener. Spencer J. Hunt, A. L. Mason and J. F. McFarland are the incorporators. J. W. Farrell, in charge of an engineering corps, has begun the survey of the company's line between Crawfordsville and Hoofston, Ill., by way of Attica and numerous towns along the line. Spencer J. Hunt represents the capitalist building the road, and is arranging to let the contract as soon as the survey is completed.

Street Railway Journal

Vol. XXVII. NEW YORK, SATURDAY, FEBRUARY 10, 1906 No. 6.

Published Every Saturday by the

McGraw Publishing Company

Main Office:

NEW YORK, Engineering Building, 114 Liberty Street.

Branch Offices:

Chicago: Monadnock Block.

Philadelphia: Real Estate Trust Building.

Cleveland: Cuyahoga Building.

London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York"; "Stryjourn, London"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada, Mexico and the Canal Zone.

Street Railway Journal (52 issues)....................$3.00 per annum

Single copies ....10 cents

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August and November) $4.00 per annum

Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy)....................$6.50 per annum

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues), postage prepaid.................... $6.00

25 shillings. 25 marks. 31 francs.

Single copies....................20 cents

Remittances for foreign subscriptions may be made through our European office.

NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the Street Railway Journal.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires.

NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal 8000 copies are printed. Total circulation for 1906 to date, 49,000 copies, an average of 8167 copies per week.

City Land Values as Affected by Transportation Facilities

One of the most interesting chapters in the history of modern transportation, which we hope to see published some day, will be that devoted to the effect of city and interurban electric railways on real estate values. We believe there is hardly an instance where any other great public benefit has been the recipient of such abuse and opposition on the part of the real estate owners and dealers, and of the citizens generally, as attended the effort to introduce electric railways in this country. At first thought it seems remarkable that the residents in one city cannot or do not learn anything from another in connection with this particular industry. Nevertheless, the experience in Boston was duplicated in Philadelphia and Brooklyn, and that of both in New York, while San Francisco is still wrestling with the same problem. Perhaps one reason for this condition of affairs is that the real estate interests, from which such opposition would naturally come, are controlled by men whose property and, consequently, whose views are limited by local surroundings. The rise in real estate in a neighboring city usually has no more significance to them than if it had occurred in China or the Fiji Islands. The average property owner cannot see further than across the street when his own property is concerned, and he is usually opposed to all change, as if any alteration of existing conditions meant depreciation. For this reason the address by Mr. Vreeland, printed elsewhere in this issue, upon city land values as affected by transportation facilities, is most instructive. It analyzes some of the reasons advanced in opposition to the introduction and extension of electric railway service in New York, quotes a number of amusing examples of the way in which property owners fought against prosperity, and contributes some very valuable statistics as to the increase in the ratable value of real estate in various sections of the city. These additions to the value of the property, as Mr. Vreeland shows, were due directly or in main part to those improvements in the street railway system to which the owners were so strenuously opposed. We have never seen similar facts in regard to any other city placed in such succinct or so complete a way, and through this compilation Mr. Vreeland has placed the entire industry under an obligation to him. His address contains facts which should prove of great value to both city and interurban railway companies in securing franchises and rights of way.

Location of Interurban Lines

The first interurban lines constructed were built to parallel already existing steam roads. The promoters depended on obtaining traffic by diverting some already in existence to the electric line, on account of its more frequent trains, cheaper rates and the fact that the interurban road could pick up and discharge passengers nearer the business portions of the towns. The power of interurban lines to create traffic was then not realized, nor was their ability to handle freight and express business fully appreciated. But it has been proven that the interurban line does create traffic, and that considerable revenue can be derived from freight and express business if this is properly managed. In other words, there are almost as strong reasons why interurban lines should be pushed boldly out into new country as there are for the building of steam lines into such regions. We believe that it is time for promoters to broaden their views as regards the possible locations of electric roads and to be more independent of already existing steam lines than has been the practice heretofore. They should endeavor to cut across regions between towns that are not now directly connected by steam lines. There are many places where at present, in order to get from one town of several thousand inhabitants to another of similar size, located probably 30 miles or 40 miles distant, it is necessary to go a roundabout way on steam roads, with possibly a change of cars at a junction point en route. The country along a line directly connecting the two towns may be a prosperous farming community or may have some peculiar advantages which will cause it to become a manufacturing center as soon as freight facilities are developed. Such possible locations might in a short time give better returns than those paralleling steam lines.

Mayor Dunne Favors Private Ownership

Mayor Dunne, of Chicago, is generally recognized as the most prominent advocate in this country of I. M. O., which is an abbreviation now popularly used in Chicago to save time in referring to "immediate municipal ownership." Nevertheless, he is engaged in a controversy just at present with the Chicago City Council, as well as with the municipal authorities in Glasgow, because he insists on private ownership of what each of those bodies has always looked upon as a public utility. The incident has arisen as a result of the famous invitation extended to the manager of the Glasgow Tramways, Mr. Dalrymple, to visit Chicago last spring and make a report on the subject of municipal tramways in that city. Since the receipt of this report, soon after Mr. Dalrymple's return to Glasgow, it has been gathering dust in the archives of Mayor Dunne's office, although the City Council has been clamoring to hear what the expert had to say about the Chicago situation. Mayor Dunne excuses his refusal to make the report public on the ground that Mr. Dalrymple was invited to visit Chicago by the Mayor in his private capacity, that his expenses were paid by the Mayor himself, and that consequently the document is one of those few species of property which the Mayor still considers is subject to private ownership. This theory is strongly combatted, not only by the City Council, but also by the Lord Provost of Glasgow. In a recent letter to Mayor Dunne, the latter writes that the corporation "clearly understood that the request came from you not as an individual, but as the Mayor of the city, and this opinion is confirmed by the terms of the following cablegram sent to you in reply:

" 'Mayor, Chicago, U. S. A.—Corporation of Glasgow unanimously and cordially agree to request of your municipality. Tramways manager unable to leave before May 10. Letter follows. LORD PROVOST.' "

The Lord Provost further states that if it had been made clear to the Glasgow corporation that the request was made, as claimed by Mayor Dunne, as a private individual, there is little likelihood that the application would have been granted, and that the corporation fully expected that the report would have been accessible not only to the Council of Chicago, but to the members of the Glasgow corporation themselves. He concludes by stating that unless the Mayor is prepared to submit Mr. Dalrymple's report to the Council of Chicago or to show good reasons why it should not be submitted to them and to the members of the Glasgow corporation, the tramways committee will feel it has no alternative but to ask Mr. Dalrymple to send a copy of the report to the Chicago Council, as desired, and also to furnish a copy thereof to the members of the Glasgow corporation. As the Council has already passed a vote asking the Lord Provost for a copy of the report, it looks now as if it will not be long before this famous manuscript sees the light of day. It is needless to say that the controversy over the publication of this report and the desperate efforts made by Mayor Dunne to prevent its contents becoming known have greatly whetted the public curiosity and impatience to learn its import.

This incident is in one sense unimportant, but in another and in a broader sense it is of vital consequence, as it indicates the character and disposition of one of the most prominent advocates of municipal ownership in this country. If there are drawbacks to the policy of immediate municipal ownership of the street railways in Chicago, the citizens are entitled to know them, and if the Mayor was not blinded by demagogism or fanaticism he would be the first to enlighten them with all the facts at his command. Incidentally he has shown his unfitness for the office which he occupies by endeavoring to suppress testimony which may throw some light upon this, to Chicago, most important subject. In this particular case the attempt to conceal the truth miscarried because the circumstances surrounding the effort were known to too many people, but the incident is sufficient to impugn the sincerity of the Mayor in his advocacy of any future municipal ownership measure.

Testing Armatures in the Winding Room

Armature testing facilities are sadly lacking in a large number of shops throughout the country. When it is considered that quite a large per cent of shop maintenance expenses goes for labor and material in winding armatures, one would naturally think that the winding room would be provided with every facility obtainable for testing armatures and locating faults in them. Notwithstanding this, the writer has encountered shops where there were no testing devices in the winding room other than a lamp bank. This is well enough in testing for shorts between segments and between coils before the top leads are laid, and also for testing for a ground between the windings and the core, but after the top leads are laid a lamp bank is utterly useless for discovering shorts between segments, crossed leads and similar defects. Where such simple testing apparatus is used, there is no assurance when the armature leaves the winding room that it will not "go up" when put in a car. When this does happen the armature must be returned to the winding room, a few or probably many new coils inserted, and to the expense of doing this must be added the cost of putting it in the car and removing it. It is therefore an expensive procedure.

An incident which recently came under our observation illustrates the force of this remark. An armature was rewound completely after having been well torn up by a broken band. When placed in the car it made a few revolutions and then there was a puff of smoke. The car was jacked up, the motor was opened and the armature was returned to the winding room. Several coils were replaced and it was again placed in the motor shell. This time the previous performance was repeated. Once more the armature went through the winding room and was again placed in the motor. This time, however, the wheels of the truck were jacked up clear off the track and a water rheostat was connected in series with the machine. It was discovered that the motor would just start at 200 amps. For a fourth time the armature entered the winding room. Several of the leads were lifted, and after a series of tests it was discovered that the top leads were placed two segments beyond their proper position. This made three separate windings on the armature and resulted in a consumption of approximately nine times the normal amount of current. The point intended to be brought out by relating this incident is that all the trouble and expense would have been avoided had there been some systematic way of testing the armatures before they left the winding room. There are several desirable methods in use. That requiring the least outlay of money is probably the telephone test. All the apparatus necessary is an electric bell, a battery and a head telephone receiver. Terminals of the bell are placed on segments, between which are three or four others. The telephone terminals are placed on two adjacent intervening segments. The buzzing of the receiver indicates the absence of short-circuits and the intensity of the buzzing, whether or not the coils are properly connected. If a milli-voltmeter is at hand, more satisfactory and more definite tests may be made. A quick method of testing for short-circuits is that employing a transformer so designed that it can be placed in such a position that the armature coils will act as the secondary windings. This method is employed in many shops.

Before leaving the winding room an armature should be given a high-voltage test, in addition to those for short-circuits, crosses and similar defects. Such tests are made by means of a transformer giving about double the normal working voltage. Were some of the methods of testing enumerated put in practice in shops where the trust-to-luck idea prevails, it is safe to say that the decrease in expenses of the winding room would be extremely gratifying to the shop superintendent.

Street Railway Earnings

One of the vital questions that to-day confronts the manager of a street railway property is a consideration of ways and means for increasing his yearly earnings. To tell the truth, in some localities the situation is frankly disquieting, and quite recently the president of one large electric railway system has been widely quoted as proclaiming a rather gloomy prognosis of the subject. The price for nearly every commodity except transportation has risen, and people are beginning to ask themselves whether the business has not been overdone in some sections of the country, and whether the growth of traffic, and still more of profit, justifies the increase in investment. Undoubtedly there are very many properties that show increasing business, and will continue to do so year after year in virtue of the steady increase of population in the larger centers. Beyond these there is a large group of interurban properties that can show reasonably good earnings that are steadily increasing. On the other hand, there is no denying that a good many roads, serving small communities or linking them as interurban lines, have been making a showing that is by no means as good as it ought to be. The table of Ohio statistics which we published a few weeks ago, bears directly upon the point at issue. Of the eighty-six properties there tabulated, one-third, very nearly, showed a very trivial or no increase in gross earnings over those of the previous year, and twenty of them exhibit an actual decrease, generally small, rarely over 5 per cent. A somewhat smaller group showed a very marked and gratifying increase of earnings, while the rest showed improvement to the extent of but a few per cent.

It by no means follows, however, that the roads which reported a decrease of earnings were thereby put in a bad way financially. In fact, eleven of the roads showing a decrease were earning above \$3,000 per mile of track, some of them more than double this amount, while some of the lines with largely increased earnings were rather badly off on the track mileage basis. In a good many cases, then, one must conclude that the decrease was casual rather than significant of any vital condition. The distribution of population changes more or less from year to year, so that a given line may be quite accidentally affected by causes that have nothing in particular to do with its operation. There are fat years and lean years in the street railway business as in other things. Turning, for instance, to the report from Massachusetts in the same issue, it is to be remarked that in average gross earnings per mile of track, the years 1901 and 1902 were decidedly subnormal. One must not therefore trust too implicitly in generalized statistics. On the other hand, there are certainly quite a few roads of which the earnings are undeniably meager, clearly not enough to put the finances on a sound basis. On the Ohio list there are ten roads earning less than \$2,000 per mile, and as many more earning little over that figure, while in the Massachusetts report, sixty-three out of the ninety-eight street railway companies were returned as paying no dividends. This is not exactly cheerful, but on the other hand, it is not as bad as it looks at first sight, for there are roads all over the country that are making a conservative return on the capital invested if they keep up their physical assets and pay the interest on their bonds. One is fully justified, therefore, in discounting rather heavily the somewhat sinister import of the published statistics, but, after all this is done, there are certainly left a good number of roads which for one cause or another are not making reasonably good earnings. Some of these roads have been promoted into locations where the traffic is not great enough at present fairly to support them. They may be able to hold on by desperate efforts until the tide turns in their favor, but some will unquestionably fall into the hands of new owners at a figure representing a sounder judgment of their earning capacity than that of their promoters.

Mergers and the Standardization of Parts

A few years ago an attempt was made by the American Street Railway Association to bring about the standardization of car equipment apparatus. A committee was appointed and rendered two reports, but practically all that was done, or that could be done at that time, was to recommend certain standards. As yet the street railway companies have not felt any urgent necessity for standards in car parts, but the merging of lines under one operating company, as has occurred at Indianapolis and at other places, and the interchange of cars over the several systems merged, which will no doubt be done, will make the adoption of standard apparatus and repair parts much more urgent. The variety of parts carried in the storerooms of any one of these systems is in many cases so numerous as to cause a heavy dead investment and a great deal of bookkeeping. To repair any car that may come on any of the lines when cars are interchanged freely over different systems, unless some provision is made for standardizing repair parts, each repair shop will necessarily carry an enormous amount of stock. No doubt one of the first moves the merged companies will make will be to standardize as much as possible the wearing parts or those subjected to breakage. In some instances this will not be a very difficult matter. With other parts, however, it will be almost impossible. The greatest difficulty will probably be met when it is attempted to make parts of trucks interchangeable. Journal boxes and bearings have to an extent been standardized, yet there are many trucks of old design having these parts of such odd shape that it will be almost impossible to make standards to replace them. Center bearings and side bearings will be equally hard to standardize. Probably the only way the difficulty can be solved will be to sell those trucks, controllers and motors of which the fewest number are in service and replace them with apparatus adopted as standards. No matter what course may be pursued, it is safe to say that the merging of different systems will tend to bring about the long desired standardization of car equipment apparatus.

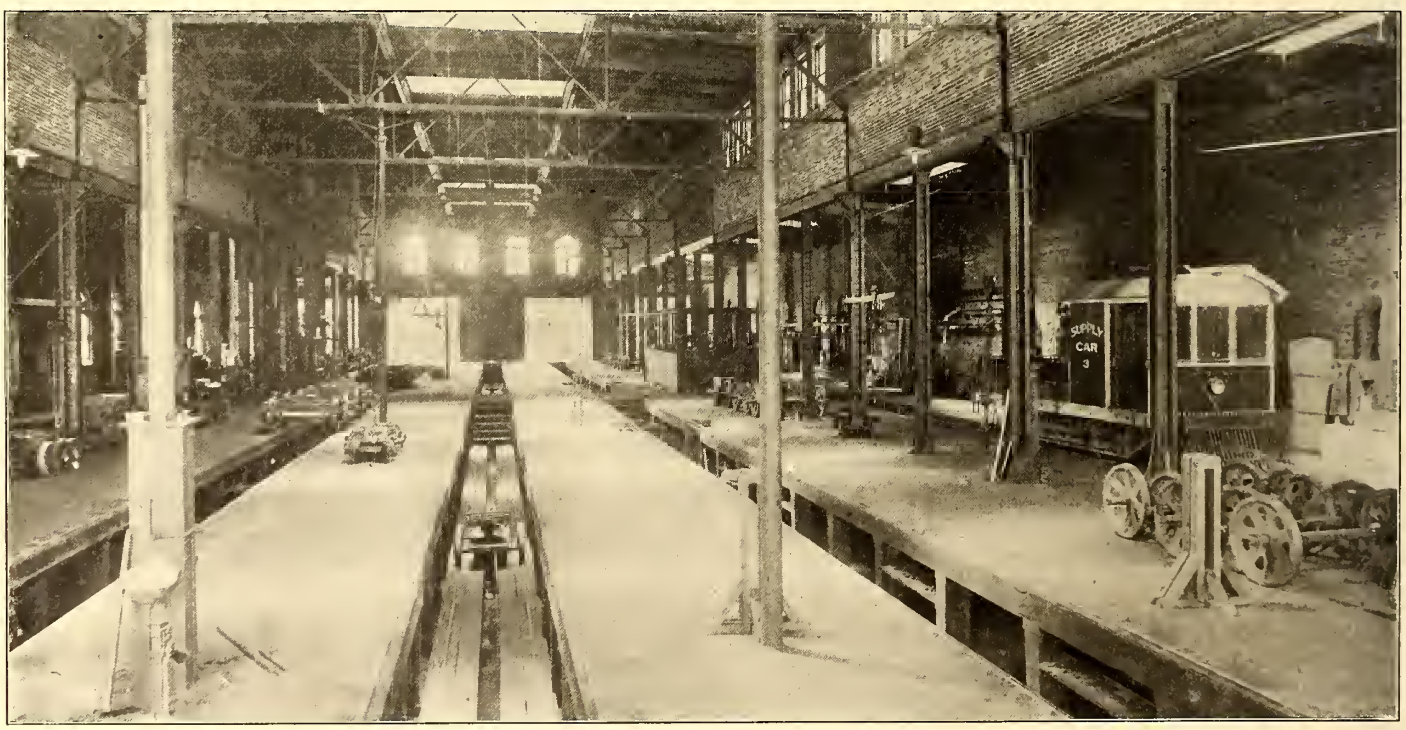
REPAIR SHOP PRACTICES OF THE TORONTO RAILWAY

The Toronto Railway Company, of Toronto, Can., has one central repair shop and car building plant and four operating car houses at which minor repairs are made. The shops and all car repair and maintenance work are under the direct charge of John Donnelly, master mechanic, who, since he assumed the office, has been able to effect a number of important economies and improvements in the mechanical department.

The repair shops cover considerable ground, the motor and truck shop alone being 212 ft. long x 75 ft. wide. From the adjoining streets five lines of track run through the shop, and cars, after they have been repaired, are run direct to a separate car house adjoining the shops, where they are kept until placed in service.

The pits in the motor and truck shop have concrete floors, and furnish accommodation for ten pit crews. It is the practice to flush the pits at regular intervals with water from the fire hose, it being found that this effectually prevents the accumulation of refuse, as well as keeping the pits sweet and clean. One of the many improvements effected by the present master mechanic soon after he took charge was the installation of a wheel-grinding plant in one of the pits. Wheels having a flattened or "skidded" tread are subjected to the wheel-grinding process and the defective part repaired. The result has been a decided decrease in the number of wheels discarded as being "flat" and unfit for use. The shop is fitted with eight fixed cranes with chain falls attached, for the purpose of lifting armatures, machines, etc., from the pits. Standard four-wheel trucks are supplied for the carriage of armatures to and from the various parts of the shops. The pits are all equipped with hydraulic lifting jacks, as described elsewhere in this issue.

GENERAL VIEW OF FIELD AND ARMATURE ROOM, TORONTO RAILWAY SHOPS

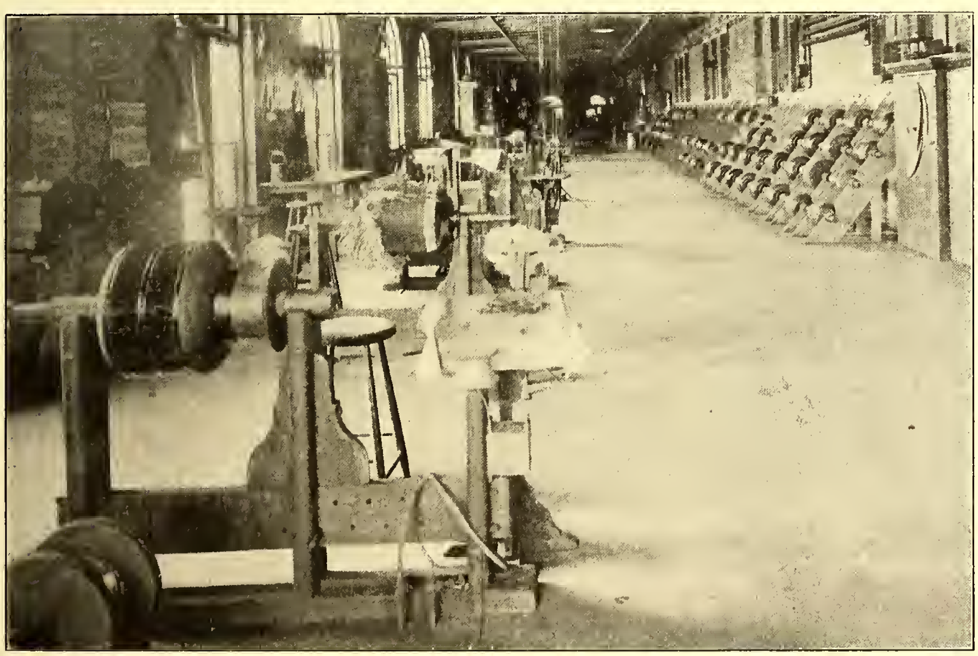


REPAIR PITS, TORONTO RAILWAY SHOP

The lighting arrangements at these shops include eight large wire-glass ventilators in the roof, as well as side windows set high up. By night both arc and incandescent lamps supply the necessary light. In common with all the shops in this building, heat is supplied by the Sturtevant system of hot air, the plant for this being situated in a separate building. A small store containing sufficient supplies for 24 hours is situated in the shop, it having been found that a considerable saving of time is effected by always having supplies on the spot. The supervision of all repairs to cars is entrusted to two foremen, the one being responsible for the work done on the electrical equipment of cars, and the other for work on the trucks and mechanical parts.

The system of reporting cars for repairs is as follows: When a car becomes crippled upon any part of the line, it is run to the nearest divisional operating station, or to the motor shop if that is nearer, and a ticket is attached stating what is the nature of the repairs required. By a rule of the shops no car is considered to be crippled unless it has this ticket attached. After the necessary repairs have been made, the men who have done the work fill up and sign the ticket, giving full particulars of the work performed, together with the time completed. This ticket is then forwarded direct to the office of the master mechanic, where the work is noted and charged against the car. By these means a complete record is kept of all repairs made to each car, which is always available for future reference.

Adjoining the motor shop and communicating with the same by iron doors are the machine and blacksmith shops. The former is fully equipped with eight lathes, three drill presses, a bolt cutter, radial drill and planer, two shapers, a wheel press and boring drill, and a complete brass finishing plant. The blacksmith shop is furnished with six forges, a large steam hammer capable of delivering a blow of 800 lbs., and a heavy punch and shears. The draft for the furnaces is supplied by a



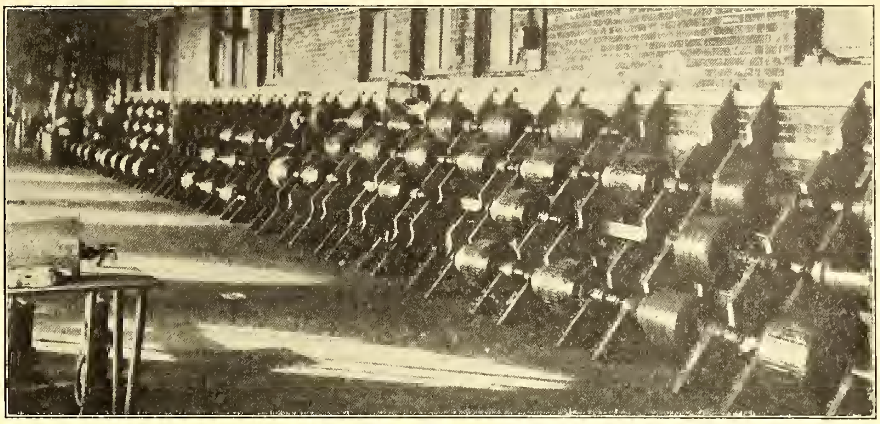
STANDS FOR WINDING ARMATURES, ARMATURE RACKS IN BACKGROUND, TORONTO RAILWAY SHOPS

40-in. Sturtevant fan. These two shops are under the respective charge of a foreman machinist and blacksmith, and both of these foremen, as well as those in the motor, truck and armature departments, are directly responsible to the master mechanic. The armature room, a description of which is given elsewhere, is on an upper floor and on one side of the motor shop. Easy access to this department is obtained by an electric elevator.

The following is a description of some of the methods, practices and devices in use in these shops:

MAKING FIELD COILS

The process of making field coils is as follows: The coils for all motors except Westinghouse 3 and W. P. 50's are formed of covered magnetic wire, cotton-covered wire being used for the last-mentioned type. After the coil is wound it is placed in the oven and baked at a temperature of about 200 degs. F. for four hours; it is then soaked in Sterling varnish for three hours and again baked at the same temperature for from nine to ten hours.



RACKS FOR HOLDING ARMATURES, TORONTO RAILWAY SHOPS

The leads are then soldered on and the coil is wrapped with four thicknesses of "Glace" belting or cotton web tape in strips 1¼ ins. wide. The coil is again baked at 200 degs. for three or four hours, after which it is soaked in Sterling varnish for four hours and baked again for nine or ten hours. When the coil is cool it is further insulated with one thickness of "Competition" rubber tape wound with half laps. It is then painted by means of a brush or an atomizer with P. & B. compound, and after air drying is ready for service.

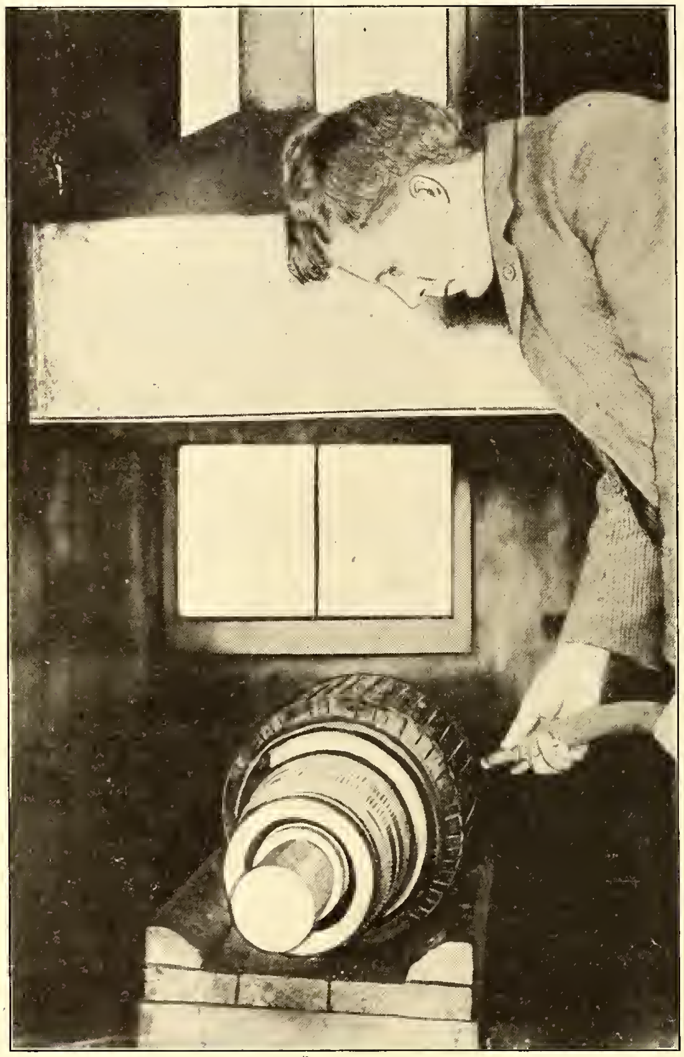
As an additional protection to field coils, it is the practice to place a piece of No. 6 duck canvas, which has previously been thoroughly soaked in P. & B. compound, between each field coil and the motor frame. The canvas layers are cut on a form with a hole in the center to permit the piece to fit down snugly around the pole piece. The addition of these layers of canvas has materially reduced the number of field troubles.

MAKING ARMATURE COILS

Armature coils are wound on forms with cotton-covered wire. The coil is then dipped in Sterling varnish for a short time and is hung up to drip and to air dry. It is then insulated with one wrapping of oiled linen tape wound with half laps. Cotton webbing is used for covering the leads. Over the oiled tape is laid one wrapping of dry linen tape, which is also laid with half laps. The coils of each type are made up in sets and placed in closets until such time as they are wanted. Before they are placed in an armature they are dipped in Sterling varnish and baked for about 1½ hours. The portion of the coil that sets into the slot of the armature core is dipped in paraffine wax to smooth it up so it will go into the slot readily. After an armature has been wound with a new set of coils it is painted all over with Sterling varnish and baked in the oven at 200 degs. F. for ten hours. The commutator is then turned down and the complete armature is tested with a millivoltmeter for short circuits, bad connections, or open circuits. It is then given a 1000-volt a. c. transformer test. The bands are then put on and the armature is painted all over with P. & B. compound and allowed to air dry until it is ready to go out.

The stands on which the armatures are wound are shown in one of the engravings. It will be noticed that to each stand is brought a gas pipe and a compressed-air pipe, by which each workman can form a blow torch for soldering, etc.

Through the courtesy of G. H. Sweetlove, the foreman of the armature department, and of the master mechanic, Mr. Donnelly, the following statistics as to the cost of producing field and armature coils of various types, as taken from shop records, are here given:



BLOWING OUT ARMATURE WITH COMPRESSED AIR, TORONTO RAILWAY SHOPS

COST OF LABOR AND MATERIAL FOR MAKING FIELD COILS COMPLETE—TORONTO RAILWAY SHOPS

	West. No. 3 Field	G. E. 67 Field	G. E. 1000 Field	G. E. 800 Field
Wire	$12.69	$13.00	$14.80	$21.90
Glace belting	.85	.85	.85	1.25
No. 6 CC cable	.35	.35	.35	.35
Tape, Competition	.60	.60	.60	.82
Varnish	.85	.85	.85	1.00
P. & B. Compound	.25	.25	.25	.25
Soft Sheet Copper	...	.05	...	...
Labor	.50	.50	.50	.50
Total	$16.09	$16.45	$18.20	$26.07

COST OF LABOR AND MATERIAL FOR WINDING ARMATURES COMPLETE—TORONTO RAILWAY SHOPS

	West. No. 3 Armature	G. E. 1000 Armature	G. E. 800 Armature
LABOR			
Stripping and cleaning core	$2.50	$2.50	$2.50
Winding	1.25	2.00	2.00
Connecting	1.25	1.25	1.25
Binding and heads	.75	.50	.50
Insulation and insulating core	.25	.50	.50
Winding and taping coils	3.00	3.00	3.30
MATERIAL			
Duck	.43	.51	.51
R. R. paper	.35	.15	.15
Press Board	...	.30	.30
Competition tape	.41	.82	.82
Solder	.20	.20	.20
Asbestos	...	.15	.15
Binding wire	.20	.20	.20
Linen tape	4.00	3.40	3.40
Webbing	.12	.12	.12
Varnish	.85	.85	.85
Linen	.46	.69	.69
Glue	.10	...	...
Wire	9.84	13.25	9.60
P. & B. Compound	.25	.25	.25
Total	$26.10	$30.64	$27.29

It is understood the cost of materials will rise and fall with the market, but the figures given are good averages. Mr. Sweetlove states that the labor item can be reduced on armatures if taping machines are used for taping coils and if banding machines are used for banding armatures. The armature cores must be in good condition, or it will take more time to prepare them for winding. At the Toronto shops each winder prepares his own armature core for winding, including stripping, cleaning and filing. He also winds and connects his own armature. By this method it is possible to hold each man responsible for all the work on each armature.

ARMATURE RACKS

For holding armatures while they are in the shops, racks are provided along one wall in the armature room, as shown in one of the illustrations. The side pieces of these racks are 2-in. x 16-in. timbers, set with one end on the floor and the other against the side of the wall, the racks somewhat resembling short ladders. The side pieces are braced from below and have notches cut to receive the armature shafts. Each rack will hold four armatures. The line of racks is served by an overhead traveling crane, to which is attached a chain drop and fall for carrying armatures to and from the racks. It is a rule of the shops that when an armature is not having actual work done upon it, it must be placed on a rack. This avoids having armatures lying around indiscriminately on the shop floor, and has resulted in eliminating all damage to armatures while passing through the shops.

CLOSETS FOR FIELD AND ARMATURE COILS

In line with the policy of providing a place for everything in the shop, the winding room is fitted with closets or lockers, in which are kept the stock of completed field and armature coils until they may be needed. The closets for armature coils are divided by shelves into compartments, each compartment giving room for one set of coils. The closets have dust-proof doors and there is a separate closet for each type of coil. These rows of closets, with each type of coil neatly piled in proper place, present a striking contrast to the more common sight of coils heaped in some out-of-the-way corner covered with dust and never at hand when wanted in a hurry. With the closets each class of coil is kept by itself, and as the closet doors are all marked on the outside, any one can readily find the particular type wanted. Moreover, by hastily glancing through the row of cupboards, the master mechanic is able to tell at once what stock he has on hand and what coils are running low.

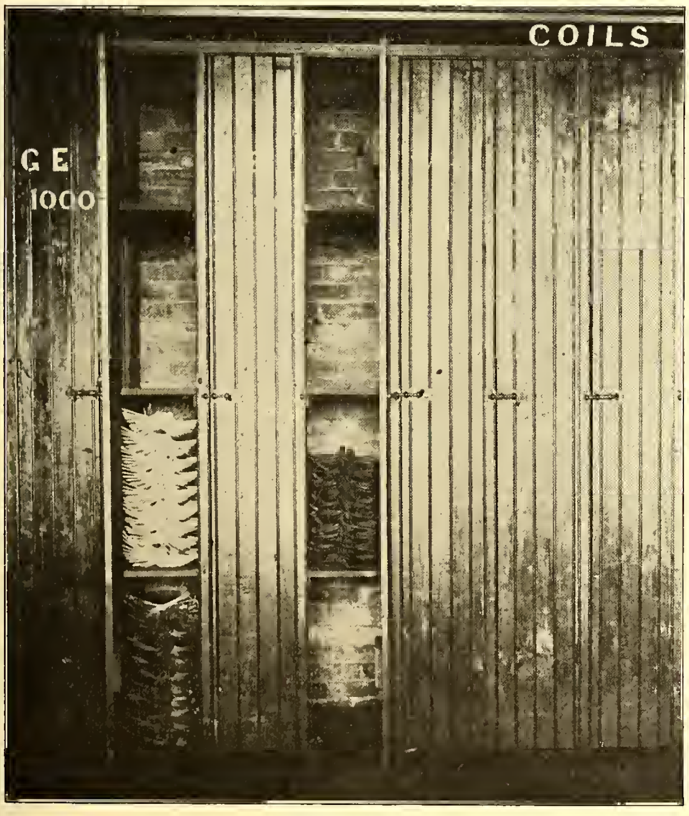
BLOWING OUT ARMATURES

It is the practice at these shops to clean those types of armatures that are wound with air spaces between the laminations of the core by means of compressed air. For doing this work a small closet has been partitioned off from the main armature room. The armature to be blown out is wheeled into this closet on a low truck and placed under a galvanized iron canopy, which is connected with the suction of the ventilating system of the shop. By means of a flexible hose and nozzle a stream of air is directed into the spaces between the armature windings and all the dust is sucked up into the canopy and carried away. An armature can be thoroughly cleaned out in this way in a very few seconds, and without filling the main room with dust. The canopy is suspended with counterweights and can be raised and lowered as desired. One of the engravings makes clear the process of blowing out armatures by this method.

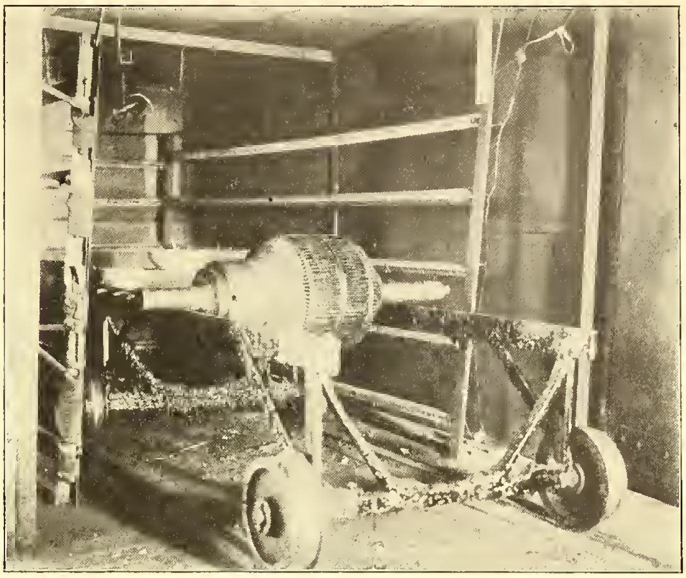
A CONVENIENCE FOR PIT MEN

For the convenience of men working in the pits, and for inspectors who may be making inspections from the pits, the car number is painted on the bottom of each car as well as on the sides. Pitmen and inspectors are often bothered about knowing just what car they are working under, and frequently have to come up out of the pit to find out the car number. This is especially true where there is a long line of cars standing over a pit track, and there is always a possibility of mistakes creeping into records and reports by reason of the men putting down the wrong car number. This is one of the little things in shop system, but the practice of having the car number painted under the floor where it can be read from the pit has been found to materially facilitate the work of the repair men, and it is a convenience they all appreciate.

Another little "wrinkle" in vogue in these shops is giving each of the pitmen a number. The men with the odd numbers always work on No. 1 and No. 3 motors under the cars and the even numbered men work on No. 2 and No. 4 motors. When a man has finished inspecting or overhauling the machine to which he has been assigned, he stencils his number on the end of the truck frame. If for any reason it is desired to know who did the work on any particular truck or motor, the stenciled number at once indicates what workman last overhauled that end of the car. This serves to place the responsibility for all pit work just where it belongs.

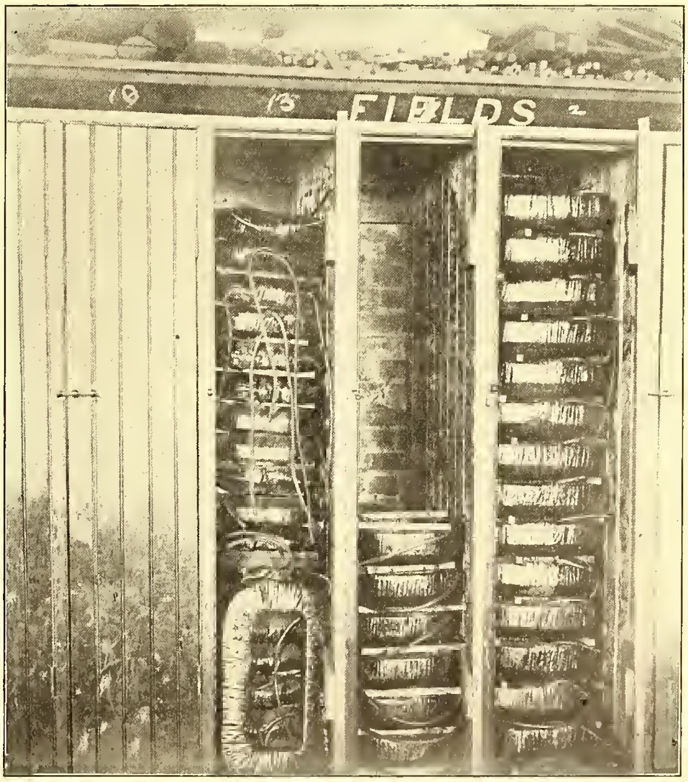


CLOSETS FOR STORING ARMATURE COILS, TORONTO RAILWAY SHOPS


INTERIOR OF OVEN, WITH TRUCK FOR HOLDING FIELDS AND ARMATURES WHEN BAKING, TORONTO RAILWAY SHOPS

OBJECT LESSONS FOR CAR HOUSE MEN

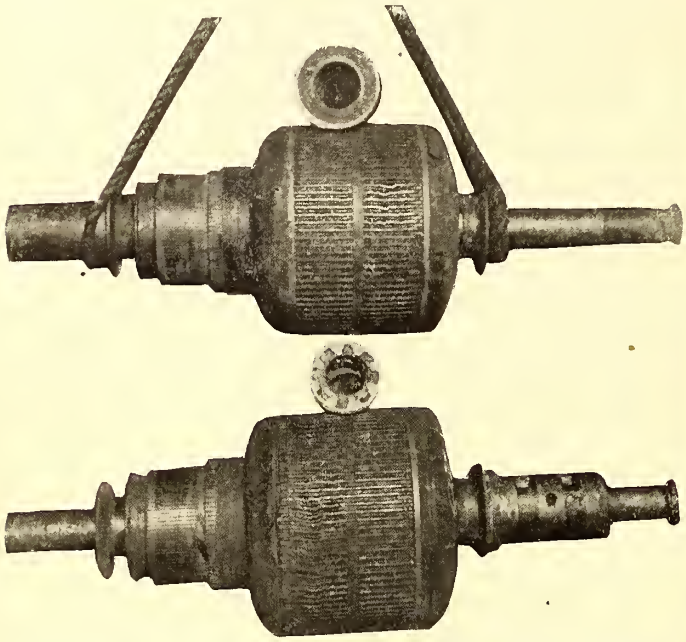
The master mechanic of the Toronto railway for some time had considerable trouble in getting the night repair and inspection men to realize the importance of avoiding low bearings in motors and the necessity for frequent and thorough inspection of all bearings. He finally hit upon the plan of photographing two armatures that had come into the shop badly damaged by reason of rubbing on the pole pieces, due to low bearings. To make clear the relation between low bearings and damage to the armature windings, the worn bearings as



CLOSETS FOR STORING FIELD COILS, TORONTO RAILWAY SHOPS taken from the shafts were placed on top of their respective armature and photographed in this position. The photograph was hung in the shop as a reminder to the men of the importance of avoiding low bearings. The photograph is reproduced in this connection as an effective way of teaching an important lesson.

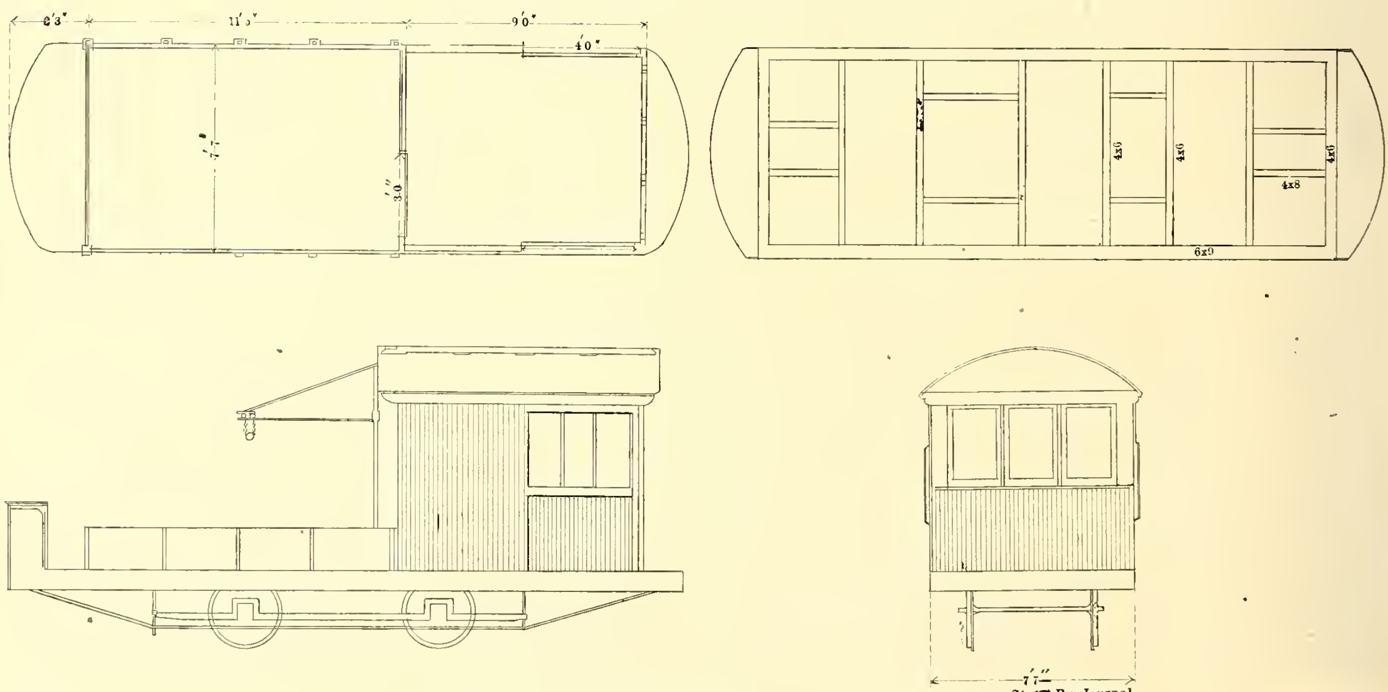
HYDRAULIC PIT JACK

For expediting repair work each shop pit is equipped with a



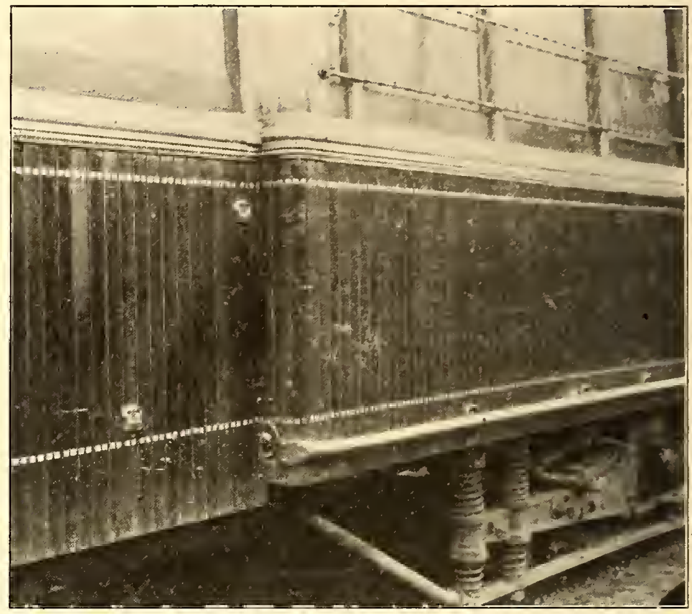
PHOTOGRAPH TAKEN TO SHOW CAR-HOUSE EMPLOYEES BAD EFFECTS OF LETTING ARMATURE BEARING WEAR LOW, TORONTO RAILWAY SHOPS

hydraulic lifting jack of home manufacture. Although the design of the jack embodies no radically new principle, the working drawings showing details are reproduced in this connection as of possible value to other master mechanics. The jack



DETAILS OF SUPPLY CAR, TORONTO RAILWAY

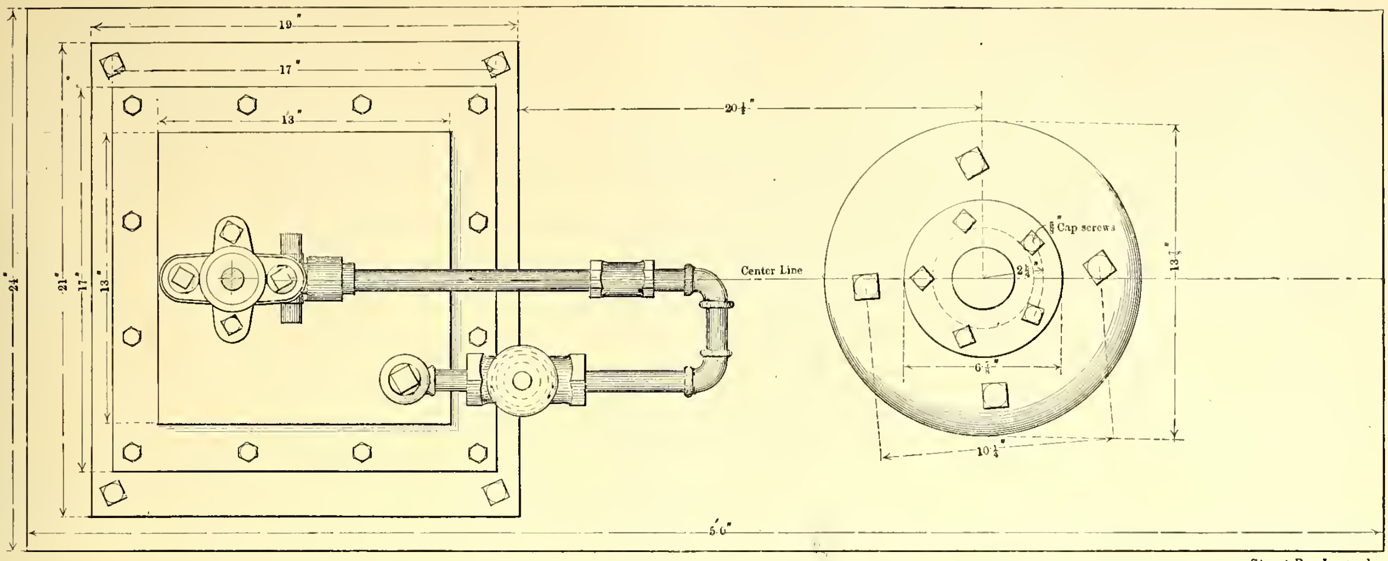
is operated with a hand pump, the pump and lifting table being mounted on a flat truck arranged to run on narrow-gage track rails laid on the bottom of the pit. The hand pump comprises a water chamber 13 ins. square and about 3 ins. high, inside measurement. This chamber is formed of ¾-in. plates and serves as a base for the pump. When the chamber is filled with water, the act of raising the pump handle draws a charge of water up through a 11-16-in. pipe and allows the charge to flow into a ⅜-in. cross channel. The act of pushing the pump handle downward forces this charge forward through a ⅞-in. pipe toward the cylinder of the lifting piston, upon which is carried the jack table. The successive raising and lowering of the pump handle continues this process, a small charge of water being forced forward into the lifting cylinder at each downward motion of the handle. It will be understood by tracing



SIDE RAIL USED ON CARS IN TORONTO TO PROTECT CAR-BODY FROM SIDE SCRAPES

the course of the water from the drawings that the valves are all arranged to open only one way, so that the direction of the water is always forward into the lifting cylinder, and the water cannot return by this course. The jack table is lowered by opening the return valve (operated by a small hand wheel), thus allowing the water to flow backward through the by-pass into the water chamber. The same water is used over and over again. This type of jack has proven satisfactory if reasonable care is exercised in keeping the valves in good condition.

The jack table on which the material or apparatus to be handled is carried is so mounted as to give an adjustment of several inches either side from the center. This is accomplished by mounting the table on a sliding plate, which is hung



PLAN OF HYDRAULIC PIT JACK, TORONTO RAILWAY

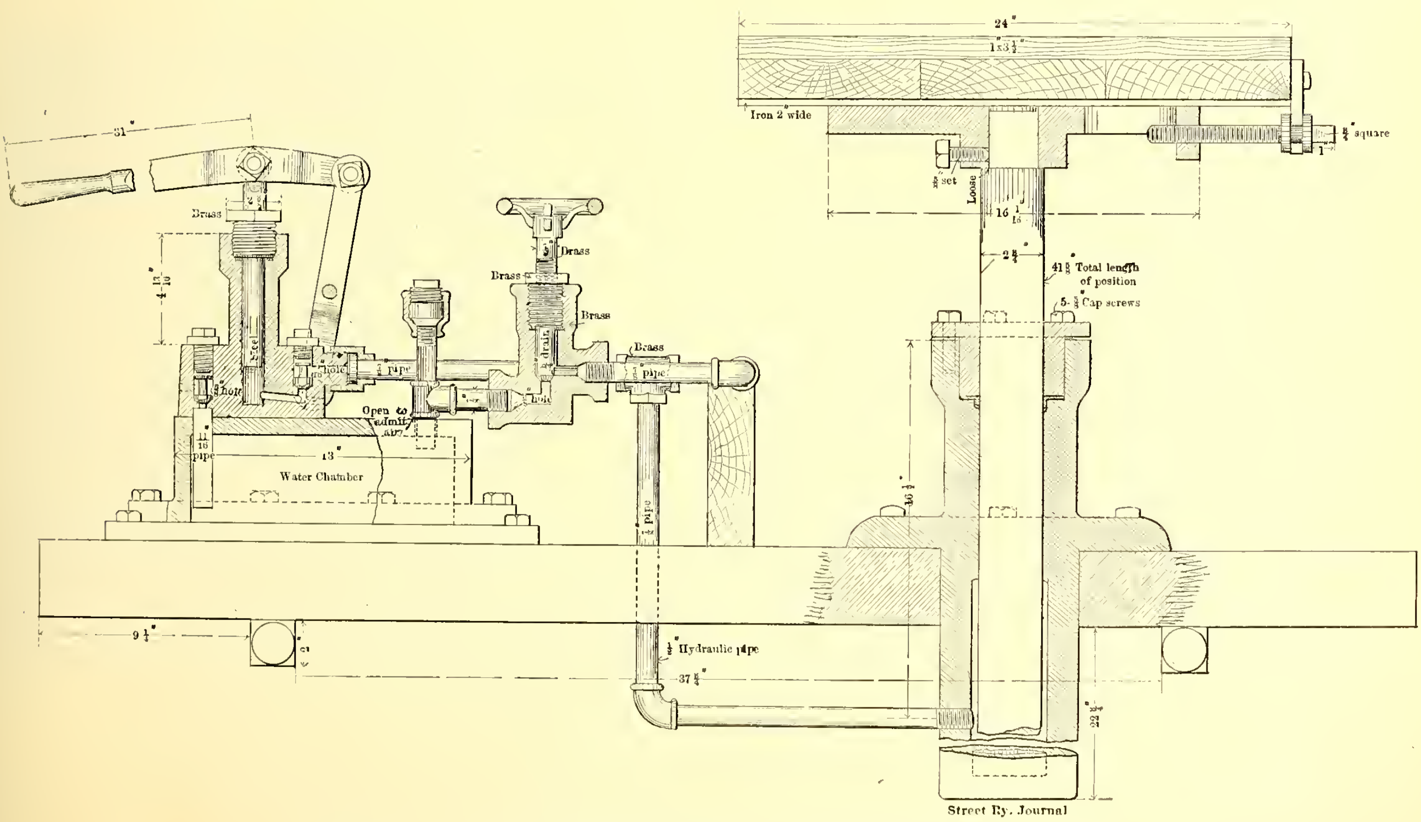
by bolts traveling in slots so that the plate can be moved either way through a considerable range by means of thumb screws.

CAR HORSE

At the Toronto shops, when work is to be done on trucks, the trucks are first run out from under the car body. The bodies are lifted by hand jacks, and when raised are supported on horses, the details of which are shown in accompanying engravings. The body rests directly on cross timbers, reinforced longitudinally with iron rods, and the ends of these timbers are supported on bolts on the horses, the bolts being adjustable to hold the car body at any height.

SUPPLY CAR

One of the important accessories to the mechanical department is a home-made supply car for distributing material and supplies to the different car houses. Before Mr. Donnelly took charge of the shops it was the practice to bring all cars to the main repair shops, even for trivial repairs. One of the first reforms instituted by the new management was the building of the supply car, and now instead of hauling cars to the shop for minor work, the supplies, such as armatures, fields, etc., are sent to the various car houses, and much of the repair work is done by car house men at the different stations. This

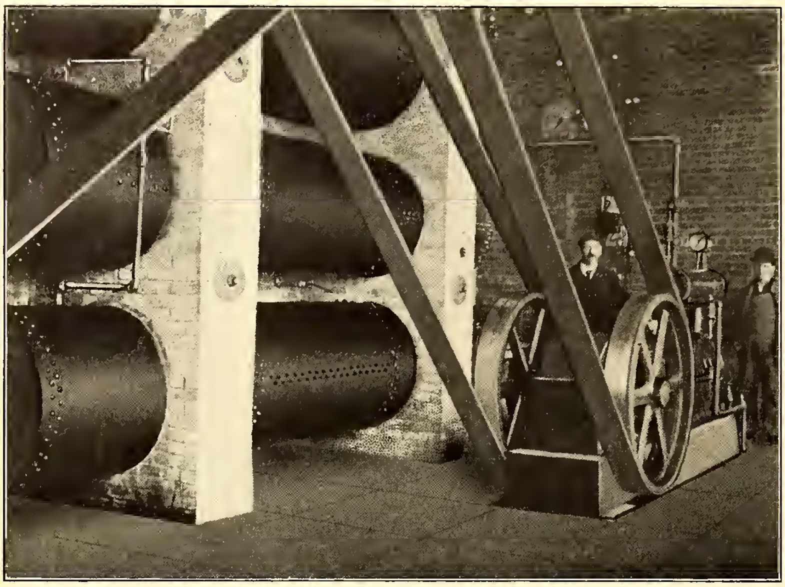


SIDE ELEVATION AND PARTIAL SECTION, TORONTO HYDRAULIC JACK

has reduced to a great extent the dead car mileage, and also decreases the length of time defective cars are kept out of service. The supply car has a flat platform with adjustable sides and an anchored cab at one end. It is equipped with swinging crane for the loading and unloading of material.

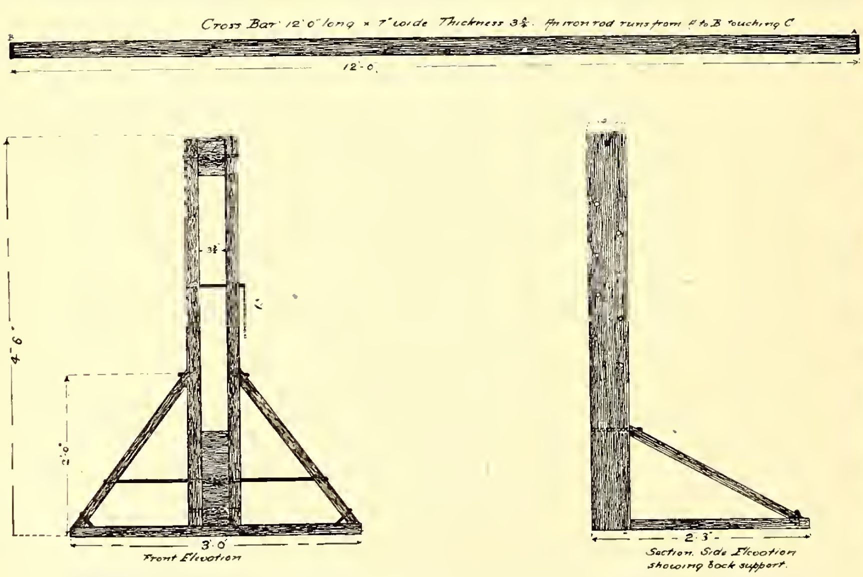
GUARD FOR SIDE OF CAR

The standard Toronto cars all have straight sides, sheathed on the outside with narrow, vertical matched strips, the chief advantage of this design, of course, being found in the rapidity with which, in case of injury to the side of the car, any strips that may be damaged can be readily replaced without disturbing those that are sound. Although a straight-sided car of this



AIR-COMPRESSING PLANT FOR SUPPLYING AIR TO MAGANN AIR BRAKES, TORONTO RAILWAY

design is more easily and cheaply repaired, this advantage is to some extent nullified by the greater number of side scrapes the car receives from passing vehicles that a car with receding panel sides would ordinarily escape. To overcome this dis-

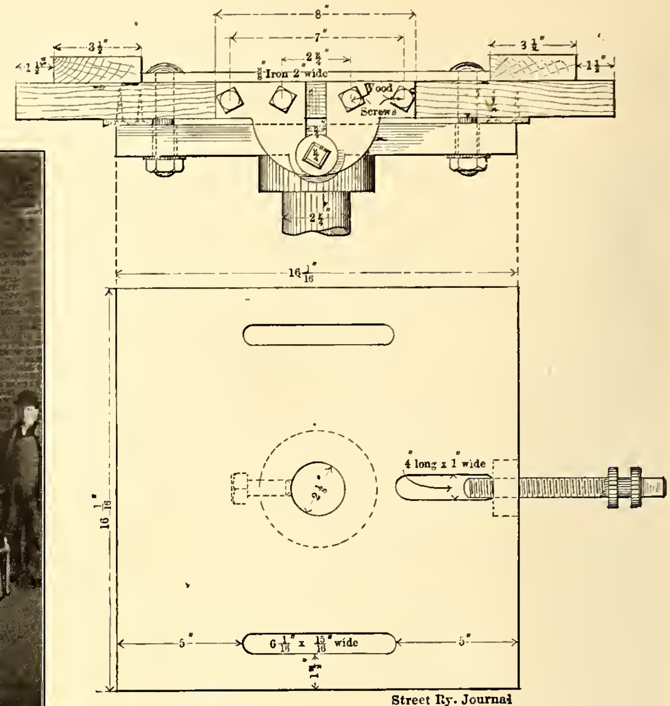


CAR HORSE FOR SUPPORTING CAR-BODY WHEN TRUCKS ARE REMOVED, TORONTO RAILWAY SHOPS

advantage, the Toronto cars are fitted with guard rails composed of iron pipe, placed along the sides near the bottom in the manner indicated, and these have been found an effective protection against damage to the woodwork.

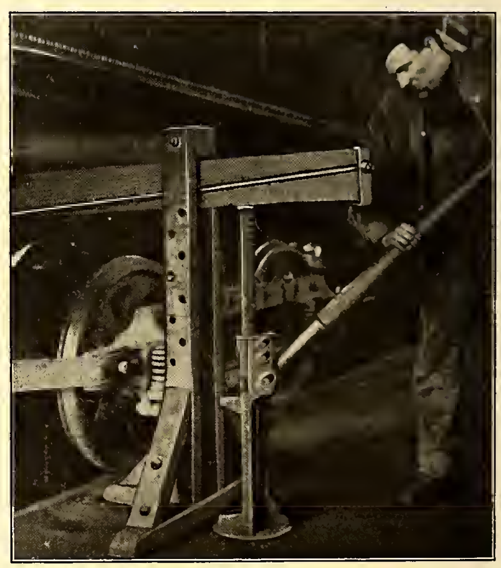
INSTALLING STORAGE AIR BRAKES

The Toronto Railway Company is equipping 330 of its cars with the Magann storage air brake system, formerly made by the G. P. Magann Air Brake Company, but now owned and controlled by the Magann Air Brake Company, Ltd., of Toronto. The system used on the Toronto cars is practically the same as hitherto sold by the Detroit company, with one or two improvements. For supplying air to the storage tanks on the cars, the Toronto Railway Company has installed at each f



PLAN AND SECTION OF TABLE ON TORONTO HYDRAULIC JACK

its four car houses a complete air-compressing plant, consisting in each case of motor driver, compressor and storage reservoirs. Charging boxes for supplying cars with air for the oper-



HORSE FOR SUPPORTING CAR-BODIES WHEN TRUCKS ARE REMOVED, TORONTO RAILWAY SHOPS

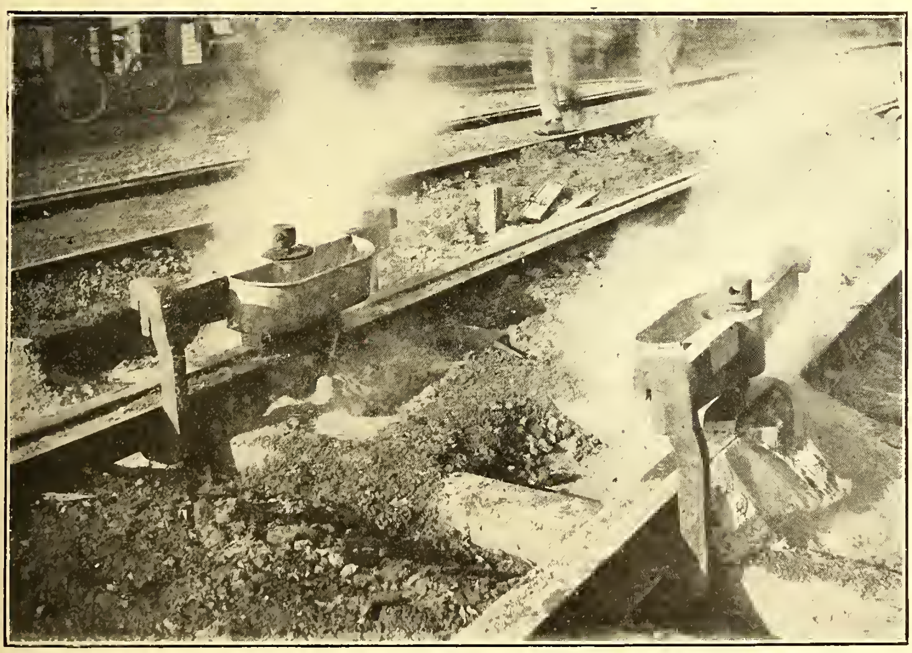
ation of the air brakes are situated at five points on the system, as well as a central plant placed in the main repair shops. It is estimated that the time taken in charging a car up to its capacity does not exceed ten seconds.

A 2-cent fare railroad bill is now before the State Legislature of Ohio, and the electric lines for once are co-operating with the steam lines in an effort to defeat the measure, which would mean severe competition for the electrics.

BONDING AND OTHER TRACK IMPROVEMENTS ON THE CALUMET ELECTRIC RAILWAY

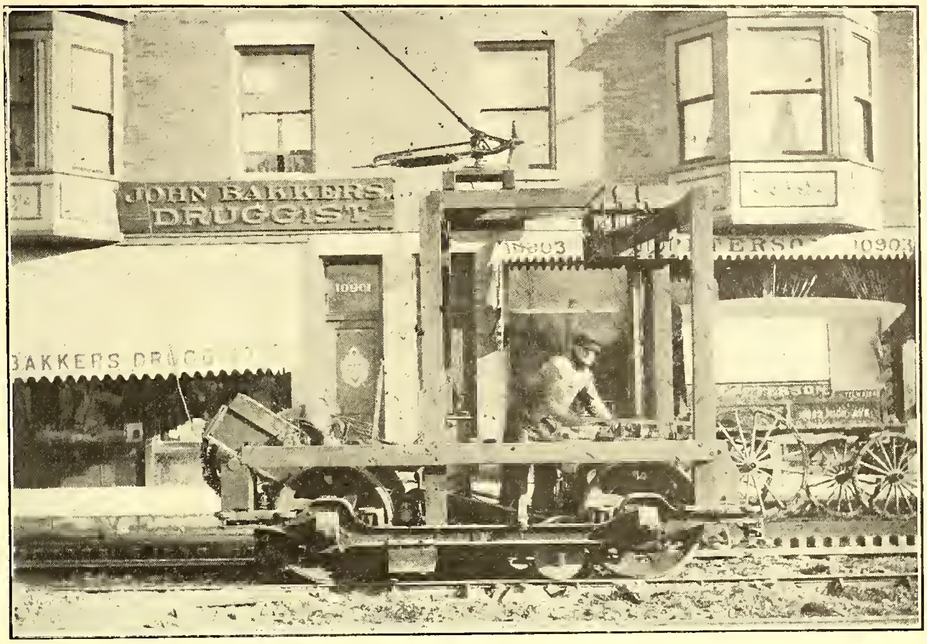
In an article published in the Street Railway Journal, Jan. 7, 1905, descriptive of the method of cast-welding rail-joints on the Calumet Electric Street Railway, of Chicago, it was stated that while H. M. Sloan, general manager of the company, did not believe the heating of the rails in casting the joint had as great a softening effect on the head as is usually attributed to this cause, he nevertheless took the precaution to put the greater bulk of the metal of the joint about the base of the rail, and thereby avoided an intense heating of the wearing surface.

Since the publication of the article referred to, Mr. Sloan has changed his method of casting the joints somewhat, making provision for keeping the temperature of the rail down to a point that precludes all possibility of softening effects. The former custom was to run the metal to a point just below the ball of the rail. Now, however, it is not allowed to come to a point above 2 ins. from the top of the rail. This in itself would tend to prevent the wearing surface becoming intensely hot, but a further precaution is taken by flooding the top of the rail with water soon after the joint is cast. The illustration shows the method of doing this. As quickly as possible after the metal has been run, and before the heat has had time to rise to the top of the rail, the segmental-shaped pans are hooked over the clamps holding the rails in position. A workman fills the pan with water, which, passing through perforations in



WATER PANS FOR KEEPING RAIL JOINTS COOL

the bottom of the pan, floods the top of the rail. The wearing surface never gets to a temperature above that at which it may be touched with the naked fingers without burning. It might be supposed that the water would run down on the cast metal, chilling the joint and increasing the liability of its breaking. The rate of flow, however, is such that practically all of the water is evaporated on the top of the rail. What little runs over does not come in direct contact with the molten metal, as the latter is still covered by the molds. To prevent the metal rising beyond the desired point, the molds for the 7-in. girder rails have a hole drilled in them at the proper height. At the present time, when casting joints on 6-in. girder rails, it is necessary for the workmen to watch the height of the metal in the mold and cease pouring when the desired height is obtained, as these molds have not been drilled.



TRACK GRINDER ON THE CALUMET RAILWAY

In the proceedings of the American Railway Mechanical and Electrical Association Mr. Sloan is quoted as saying that he made his molds 4 ins. wide. The statement is misleading. What he did say was that the weld was 4 ins. wide at the top, but widened to 13 ins. at the base of the rail, where the greater portion of the metal is placed.

The work of cast-welding the tracks of the Calumet system was begun about five years ago. At that time, according to O. G. Talmage, roadmaster of the system, who has had direct charge of the work, a great deal of the track was ready for the scrap heap. The result of cast-welding, and also of improving the bed underneath the track, has been to put these portions of the track in an excellent condition, so that the heaviest cars of the system are run over them without evidence of the rails having once been ready for the scrap pile.

Up to the present time more than 20,000 joints have been welded. The work is carried on intermittently, as it is done in connection with other track improvements. In carrying out the work, the cupola car is set at the central point of a section of track embracing forty joints. The joints are then cast in both directions from the cupola, the forty joints often being cast in one hour. The cupola is then moved to another section of track, the joints of which have been previously cleaned by a sand blast. After the molds and clamps have been removed, the joints are ground down by the grinder shown in the accompanying illustration. This grinder is manufactured by the Annable-Fitzgerald Engineering & Manufacturing Company, of Grand Rapids, Mich. The whole is mounted on a single truck, a top frame rising above to carry the trolley base and the resistance frames. A railway motor mounted on the frame drives the emery wheels and the slow-speed gears for moving the machine direct. By means of a magnetic clutch, the same motor moves the machine at an increased speed for traveling from one joint to another. The two emery wheels, one on either end of a long shaft extending between the two rails, may be moved, either vertically or horizontally, by levers and hand wheels. These wheels are placed in such positions that the operator, who occupies a seat in the center of the car, has a clear view of the position of the wheels on the rail. A K type of railway controller is employed, the resistance frames being sufficiently large to allow the motor to run continuously on resistance notches. In operating the machine but one rail is ground at a time. When the work on one joint is completed, the operator turns to the other side of the car, where a duplicate set of levers and hand wheels permits him to control the movements of the other grinder.

Some interesting reconstruction work is just being completed on about 1½ miles of double track where the rails are being bonded. About five years ago the tracks were laid directly on an 18-ft. clay fill. Throughout the intervening period of time, these tracks have continually settled, falling in some places a total of 16 ins. or 18 ins. This has necessitated considerable work from time to time in raising them. The work of improvement has consisted in digging out the clay and placing a bed of slag 18 ins. thick under the ties. A total of 9000 yds. of clay was removed from beneath the 1½ miles of track and hauled to points about 5 miles distant.

The clay at the bottom of the excavation was well rammed and a sand cushion was spread over it. Slag obtained from the Illinois Steel Company was then thrown in and rolled to a depth of about 9 ins. The rolling was accomplished by the use of a 14-ton steam roller. During this process the bed of slag was well flooded by water obtained from the city hydrants. Another layer of slag was placed on top and rolled and flooded in a similar manner, after which Indiana bank sand was washed into the 18-in. bed. Hemlock ties were laid directly on the slag and were filled in between with cinders. The whole bed was then rolled with a 4-ton horse roller. The slag used is the same as that employed in the Buffington plant of the Illinois Steel Company in the manufacture of Portland cement. When rolled hard, as has been done under the tracks of the Calumet system, it in time cements together in a monolithic mass, forming an almost perfect roadbed. Some track laid on beds of this character on Ninety-Third Street, South Chicago, ten years ago, are now in excellent condition, and there have been practically no depressions formed in the paving up to the present time.

RE-WINDING HIGH-TENSION LIGHTNING ARRESTER COILS

BY ARTHUR B. WEEKS

Fig. 1 shows the drawings of a jig for winding the high-tension lightning arrester coils which are used in many power houses for transmission lines. The parts of this jig are all made of wood. *A* and *B* are the bearings. An improvised horse can be set up on a couple of boxes and an iron strap or pipe cleat nailed over the top of the bearings. The coil is wound or unwound on the center core *C*. The copper terminal, which is at right angles to the coil, is to fit in the slot *D*. The size of the inside core *C* is made to suit the individual case.

The copper coil is made up of several strips of flexible copper ribbon soldered together at the ends, and to these ends are secured the terminals. The individual layers are not insulated, the entire ribbon being treated together. It is first insulated with mica, pasted over the copper with synthetic shellac, used very sparingly. If sufficient mica is used on the top, it is, of course, unnecessary to place any beneath, since the layers overlap with each winding. No mica is required at the sides of the layers.

When ready to begin winding, tie one end with its terminal in place in the slot *D*. With the entire coil unwound on the floor, place a heavy weight on the further end to give it tension. Just in front of the jig, nail a piece of wood to a box; this piece of wood should have a slot to act as a guide for the copper winding. This will produce an evenly wound coil.

Over the mica, wind ¾-in. plain cotton or linen tape, lapped

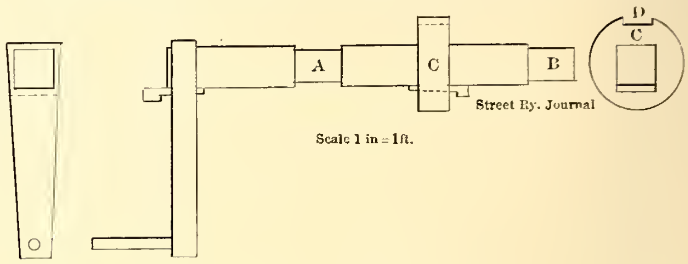


FIG. 1.—JIG FOR WINDING COILS

half way. Continue to wind and tape till the winding is completed; then, while the tension is still on, drive small wooden wedges between the layers in several places, to admit twine for the purpose of binding the several layers, to prevent the least tendency toward unwinding.

The linen tape is wound from a large coil into small ones,

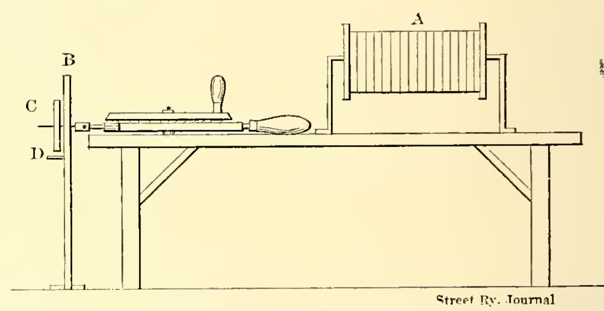


FIG. 2.—BENCH FOR WINDING COILS

to admit of more easy handling. To do this readily, where no lathe is at hand, fasten an ordinary breast drill to a bench, as shown in Fig. 2. *A* is the large coil of tape; *B*, the board used as a guide for the wire, is also used as a guide for the roll of tape *C*. *D* is a nail used as a gage for size of coils of tape.

If more convenient, place coil *A* on the floor or box in front of the operator. This handling of tape in small rolls of about 3 ins. in diameter will greatly facilitate the taping operation.

After winding, dip the completed lightning arrester coils in a good insulating varnish. Bake well to a deep brown, if clear varnish is used. Dip and bake again. They can then be painted black with a good air-drying finishing plant, if desired.

Albert Eastman, superintendent of employment for the Public Service Corporation, of New Jersey, sends the following example of a reference letter recently received at his office.

The letter is addressed to "The Company of the Trolley Car, Hoboken," and reads: "I heard that Mr. John Smith made application to get the Position on the car so I notice you that I know him Personally since the last Three Years for a honest man, his character is first class where it is very seldom to find a man like him I am sure that every one will give a good reference about him, as Mr. John Smith is all over known for a Gentleman."

The Milwaukee Electric Railway & Light Company is installing ten 500-hp Edgemore boilers in the basement of its new office building in Milwaukee. These boilers will furnish steam for a central steam-heating system, and during the peak of the lighting also will supply steam for three 1500-kw turbo lighting units which the company has just ordered from the Allis-Chalmers Company.

SINGLE-PHASE RAILWAY IN PARIS

BY P. LETHEULE

Single-phase traction is now being attempted in Paris, with motors of the Latour type. The essential difference between this motor and motors of the series and repulsion types is shown by Fig. 1. Briefly, the Latour motor differs from the straight series motor by the addition of a pair of short-circuited brushes which are at right angle with the main brushes of a series motor.

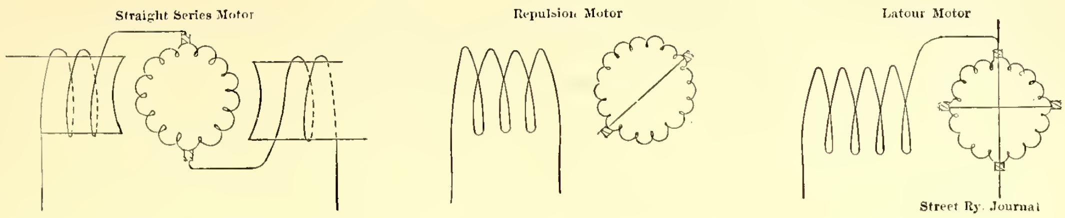


FIG. 1.—DIAGRAMS SHOWING CONNECTIONS OF DIFFERENT TYPES OF SINGLE-PHASE MOTORS

The Compagnie Générale Parisienne de Tramways, which is conducting the experiment with single-phase traction, is one of the largest operating companies in Paris and has reserved 1 mile of track on its Malakoff division for the experiment. The rest of the system is supplied with direct current at 500 volts. The experimental section of line receives single-phase current at 25 cycles and 500 volts from a motor generator fed with direct current from the trolley wire. The car is similar to the usual d. c. cars, and differs from them only in the motors and the controllers. The truck is equipped with two Latour motors, which are geared to the axles with a gear reduction 1 : 4, 6.

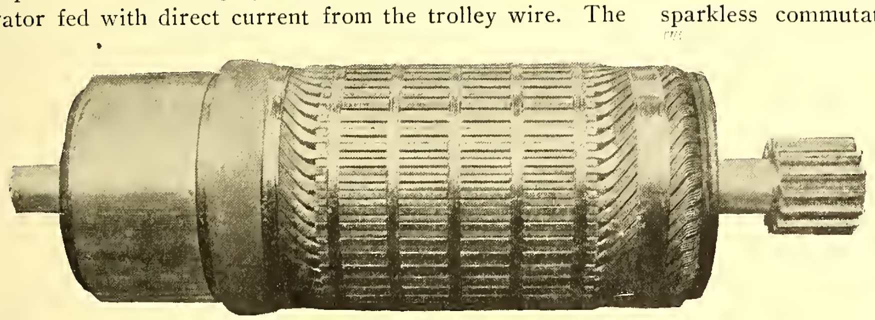


FIG. 2.—ROTOR

Each motor has four poles, is of 50 hp, and is wound for 300 volts, 25 cycles, a. c. The actual weight per motor is 1350 kg (2970 lbs.). The rotor (Fig. 2) bears a great resemblance to the usual armature of d. c. motors. The gap is much less, being only 2 mm (0.08 in.) clearance between the rotor and the stator. The stator is shown in Fig. 3. No special feature is to be found in it, and the good characteristics of the Latour motor seem to be due to the combination of the series motor features at starting and of the repulsion motor features at the high speed. Good commutation is obtained by properly proportioning the commutator and brushes. There are four short-circuiting sets and four collecting sets of these brushes—i. e., eight sets in all.

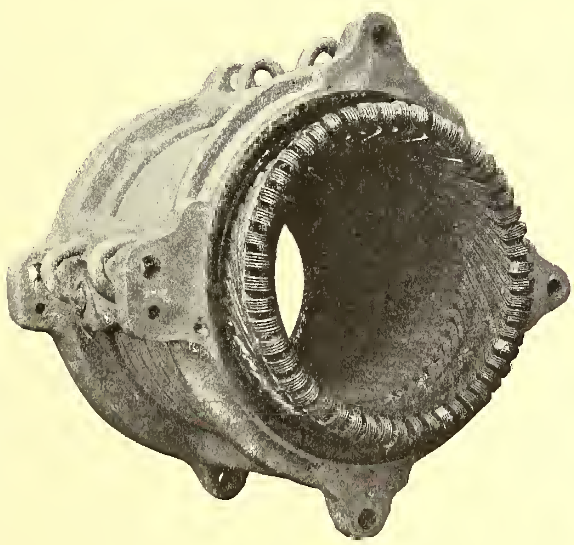


FIG. 3.—STATOR

Both motors are permanently connected in multiple with the divided secondary winding of a transformer, the oil bath of which is suspended under the center of the car. The maximum secondary voltage is 300 volts, and the remaining taps of the secondary winding are progressively connected to the motors for starting and regulating the speed. The actual weight of the transformer amounts to 1100 kg (2400 lbs.), and it carries seven secondary taps.

The controller is illustrated by Fig. 4. It has a knife or disc commutator provided with seven notches, and carries a cylinder type reversing switch enclosed in the same casing. As the controller is connected only with the low-tension winding of the transformer, there is no difficulty in raising the trolley voltage as high as convenient. Tests have been made with load varying from 3 tons to 4 tons, and the starting torque has exceeded three times the full load running torque.

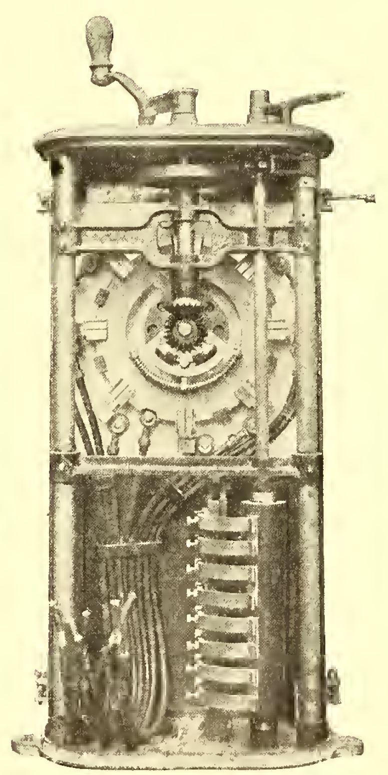


FIG. 4.—CONTROLLER

Sparking tests have been made by hauling the car with one motor only, and by starting directly under 300 volts. The sparkless commutation obtained under these conditions has shown that the service to be performed would allow of an appreciable reduction in weights and dimensions. The combined efficiency is stated to be 84 per cent, though no details are available on the conditions and method of measurement.

The Cleveland & Southwestern Traction Company, at its annual meeting, elected F. T. Pomeroy, president; A. E. Aikins, first vice-president; S. C. Smith, second vice-president; E. F. Schneider, secretary, and J. O. Wilson, treasurer. Mr. Wilson succeeds F. C. Fuller, who recently retired to devote his attention to other business. The gross receipts for the year were $543,227, as compared with $475,361 for 1904.

THE QUESTION BOX

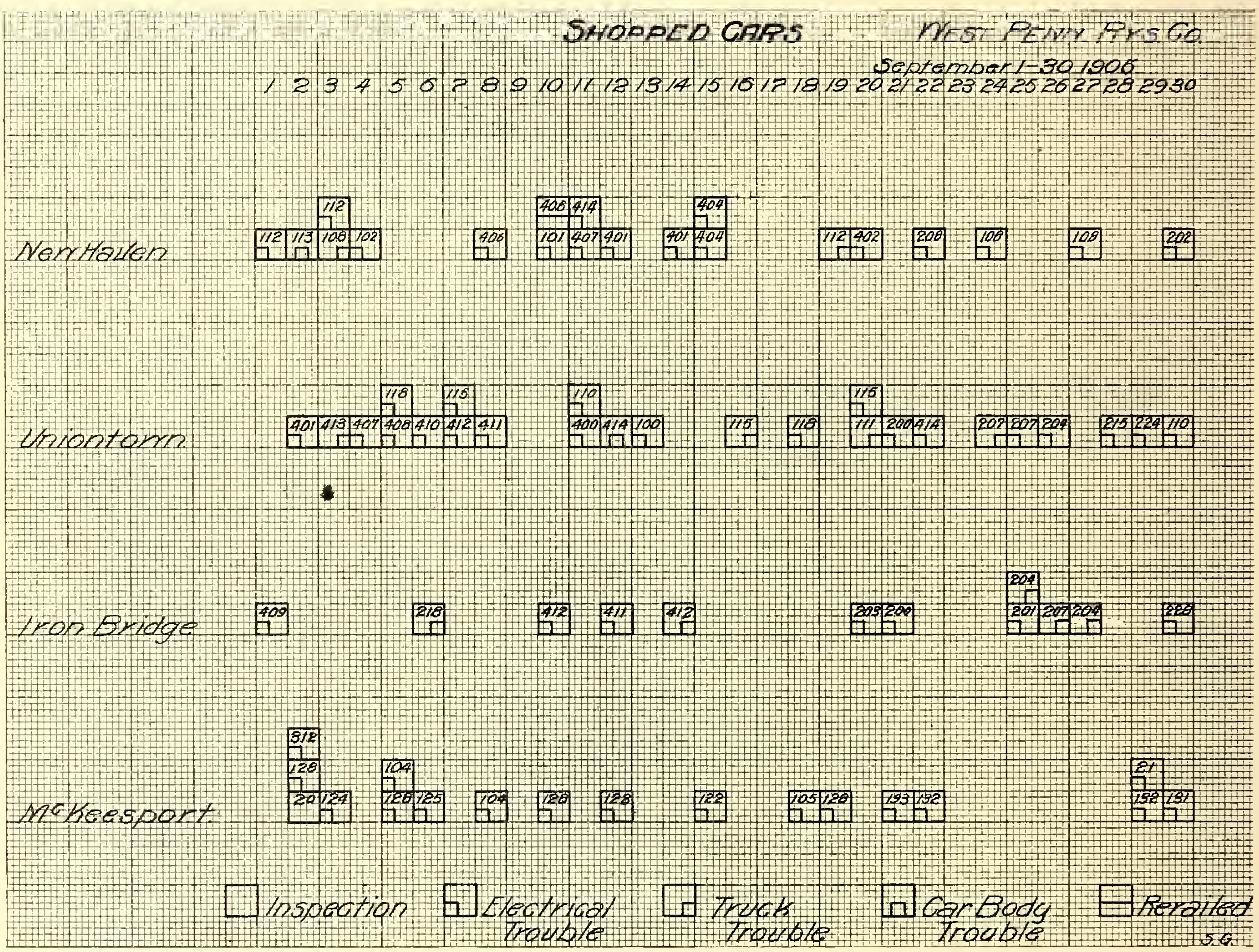
The answers this week refer to breakdowns in streets, brake-shoes, car painting, line cars, bond testing and devices for the track department. Additional answers to any of the questions will be acceptable.

MECHANICAL

AVOIDING BREAKDOWNS IN STREETS

C1.—What percentage of the total cars in service on your road during the average day have to be pulled in from service owing to defects or breakdowns developing while the car is on the street? What are you doing to reduce the number of cars that have to be taken from service on this account?

We are operating four car houses at present on our system. On our interurban lines, a car is liable to be shopped at some other car house than that from which it was started out. As it would be manifestly unfair to charge up against a car house a shopped car that did not belong there, each car house foreman is instructed to mark down on his daily "shopped-car register" report a record as to what car house a shopped car belongs. Failing in this, the car is marked up against him. There is also a column in the "shopped-car register" form for name of motorman who was operating car when it was shopped, and these records kept over some time show how surprisingly few cars are turned in by some men and how surprisingly many are turned in by others, emphasizing what a strong factor a good motorman is in keeping down petty car troubles. Each car house foreman makes out daily the "shopped-car register" report, and these are each day sent to the office of the engineer of rolling stock and shops, where they are entered on a sheet which contains all of the car-house records. In this manner, car operations over the entire system can be closely watched, and any letting down in careful work is quickly noted and definitely located. At the end of the month, blue prints are made of this sheet and a copy sent to each car house foreman, and this copy is posted on the bulletin board. The car house foreman can thus see his entire record at a glance, and also compare his work with that of other foremen. On this graphic record each car is represented by a square. The number of the shopped car is printed in the square, and the square is further marked in accordance with symbols shown at the bottom of the page, so that the particular cause of trouble can be readily noted. This graphic record system of "shopped cars," besides keeping every one interested accurately posted, has also built up a good, healthy competition between the different car house foremen, and has had a marked influence in diminishing number of delays to service.



DIAGRAMMATIC METHOD OF KEEPING RECORD OF SHOPPED CARS, WEST PENN RAILWAYS

J. W. Bridge, Engr. of Rolling Stock,
West Penn. Rys., Connellsville, Pa.

One per cent; interurban cars are inspected once every two days, or about 600 miles' run between inspection; city cars are inspected every third day, or about 500 miles' run between inspection. If inspection shows anything that is liable to develop into a cause for breakdown, it is repaired at the time of inspection. Dayton, Springfield & Urbana Elec. Ry.

Our records show that the average for the first six months of last year was 2 per cent. We have a man stationed at a central point on the system who is capable of making slight repairs and adjustments, such as can be made without interrupting the service. We think this the most effective and economical means to avoid pulling cars off the road for defects of a trivial nature. W. A. McWhorter, M. M., Birmingham Ry., Lgt. & Power Co.

The average number of breakdowns in the street on this division is less than 1 per cent; our methods of overcoming this serious condition have been to require that every car go through the shops, under a system of inspection and general repairs, every tenth day; by so doing we anticipate reducing the breakdowns to a minimum. The average varies, rising and falling in accordance with the weather conditions. In the summer time lightning has must to do with this condition, and in the winter time heavy snows and frosts interfere greatly. H. A. Johnson, Ch. Engr., Public Service Cor., So. Jersey Div.

Brake-Shoes

C2.—What are you doing with the brake-shoe question? What type of shoe are you now using, and what mileage are you getting? What have you done to reduce the cost of brake-shoes per 1000 miles?

We are using ordinary cast-iron brake-shoes on Peckham trucks on our interurban cars. The shoes weigh 33½ lbs. Our average mileage for two years has been 21,751 miles per shoe. The cost per thousand car-miles (8 wheels) has been 23.9 cents, or about 3 cents per thousand wheel-miles.
Toledo, Fostoria & Findlay Ry. Co.

We are using the diamond S shoes on inside brakes, and are getting 6000 miles on 40-ton interurban cars and 10,000 miles on 20-ton city cars. Brake beams are kept in good alignment and heads are renewed when worn out.
Dayton, Springfield & Urbana Elec. Ry.

The price of brake-shoes per thousand miles varies materially with the type of car and class of service. For the cars that we have running on our long-distance suburban lines we prefer to sacrifice the shoe for the braking effect, and in this case a soft shoe is used. In the case of city service and slower speeds, a shoe of high texture is used and an endeavor made to increase the mileage of the shoe. We find that great extremes can be gone to in this respect; a shoe of a hard nature gives better braking, but has a great deal to do with the flattening of wheels and the length of service of wheels. A shoe too soft will require adjustment too frequently, and run up the cost of shoe to a great extent. Type and class of shoe should be a matter of judgment on the part of the persons in charge. H. A. Johnson, Ch. Engr., Public Service Cor., So. Jersey Div.

Car Painting

C3.—What is your general system of car painting? How have you been able to reduce the cost of painting cars? (Suggestions on car painting and itemized statements of labor, material and costs of car painting are requested in this connection).

Owing to a fire, our car-painting practices have been greatly hampered. Our customary way, however, was to paint from the wood out once every three years, and to use finishing varnish only. We send each car into the paint shop for cleaning and varnishing every six months, the number of coats given depending upon the condition of the car, number of miles it has run, etc. H. A. Johnson, Ch. Engr., Public Service Cor., So. Jersey Div.

The following is our procedure in painting a 30-ft. car-body, 40 ft. over all, full vestibules, with detailed cost of same. After special care has been given the steel and iron work, all rust scales removed, woodwork made as smooth as sandpaper can make it, and all crevices, nail holes, screw holes, etc., dusted out, we proceed to prime with pure lead and linseed oil with about 5 per cent turpentine. We consider this the most important coat to go on the car, and special care is taken that every part of the body is thoroughly covered and that the primer is well rubbed in. This coat is allowed to dry ninety-six hours (four days). On the fifth day the work is continued with a second coat of lead and oil. On the sixth day all nail holes, screw holes, etc., are puttied. On the seventh, eighth and ninth days one coat of No. 3 or "C" surfacer. On the tenth day, rub with block pumice stone. Eleventh day, two coats of color. Twelfth day, the car is ornamented and given two coats of railway finishing varnish, forty-eight hours between coats. Total time required, fifteen days. After eight or ten months this car is taken in and given a third coat of finishing varnish, no rubbing varnish being used on the exterior of the car. By this means we are enabled to get two years' service with three coats of varnish, whereas if the three coats are applied when the car is painted, it will be necessary to add a fourth in about twelve months.

By the method described above, which is a combination of the knifing process and rough stuff process, we get a lead base, which the writer believes is conceded by all master painters to be the very best. We are also enabled by the use of rough stuff to get a much finer finish than is possible by the knifing process. The interior of the cars, which is mahogany, is finished in the usual way, being given a coat of filler consisting of cornstarch, rubbing varnish, japan, turpentine and burnt sienna, with two coats of rubbing varnish.

COST OF LABOR AND MATERIAL FOR PAINTING 30-FT. BODY CAR AS OUTLINED

	Labor	Material
Pure lead and oil, two coats	$4.00	$1.75
Putty	2.80	.50
Rough stuff, three coats	4.80	8.50
Rubbing	8.00	.45
Color, two coats	2.00	1.25
Decoration, gold	5.00	3.60
Finishing varnish, two coats	2.50	5.00
Roof, lead and oil, two coats	1.00	5.50
Filler, interior, one coat	2.00	.30
Rubbing varnish, two coats	5.00	5.00
Rubbing with rotten stone and oil	2.00	.50
Floor, one coat	.25	1.25
Total	$39.35	$33.60

This gives a total of $72.95 for labor and material. The above is the cost of painting a new car of the dimensions given. For an old car, add $20 to cover cost of burning off and removing old varnish, scrubbing, etc.

To reduce the cost of painting, we have discontinued the use of rubbing varnish on the exterior of our cars, applying two coats of finishing varnish, as described above. While this does not materially change the first cost, the life of the painting is prolonged, thereby reducing the cost in the end. We do not remove the seats from the car for scrubbing and finishing, as is the practice on a great many roads. Where the Walkover type of seat, with heaters attached, is used, it is a very expensive operation to take out the seats. We only remove the cushions, the backs and frames being cleaned and finished in the car. It might be added that we have eliminated all scroll and superfluous decorations, which are very expensive, and we think add very little to the appearance of the car. W. A. McWhorter, M. M., Birmingham Ry., Lgt. & Power Co.

LINE

Line Car

E2.—Please give description, with photograph or drawing if possible, of your line-repair car, or cars, including particularly any novel or especially desirable features.

Our line car is an old 16-ft. car with a standard line wagon table mounted thereon, which can be raised and lowered in the same manner as it is on the wagon. This has proven itself a most useful equipment, and is in constant service. It is used at night to make regular repairs, and during the day for inspection and repairs. H. A. Johnson, Ch. Engr., Public Service Cor., So. Jersey Div.

Tools in Line Car

E3.—Please give a list of tools it is your practice to carry on the line-repair car, or wagon, in order to enable the crew to do everything in the ordinary run of line repair work.

The writer believes the question of proper tools to equip a line wagon or line-repair car is a matter that requires considerable thought, as linemen are, as a rule, greatly prejudiced in favor of certain classes of tools. We have invariably found the best results by supplying the men with the class of tools they most prefer. There are so many varieties that it is not always wise to standardize any peculiar list.

H. A. Johnson, Ch. Engr.,
Public Service Cor., So. Jersey Div.

The following is list of tools kept on our line car (which was described in the Street Railway Journal for Aug. 8, 1903): Two pike poles; two sets digging tools (bar, spoon and shovel); two tampers; one dead-man or Jenny; one cant hook; one snatch block; one hand line; one pair tackle blocks, double triple 2½ ins. with ½-in, rope; one pair tackle blocks, double triple 3½ ins. with ¾-in rope; one ratchet wrench for pole ratchets; one 12-in. monkey wrench; one pair No. 2 easy wire clippers or bolt clippers; one tool for snapping on hangers; one tool for tightening insulators; four trolley clamps; two small "Havens" clamps or "come-alongs"; one large "Havens" clamps or "come-alongs"; one pick; one No. 2 shovel; two wheel replacers; two swan dry-powder fire extinguishers; one medium size pean hammer; one hand saw; one No. 2 framing chisel; one carpenter's brace with ¼-in., ½-in., ⅝-in. and ¾-in. bits; one hand axe; one cold chisel; two pair 12-in. gas pliers. John A. Beeler, Vice-Pres. & Gen. Mgr., Denver City Tramway.

TRACK

Testing Bonds

F1.—How do you test your rail-bonds?

We test our rail-bonds with a "Roller" direct-reading bond tester. E. D. Reed, Engr., Scranton Ry. Co.

We have found the Conant bond tester, though somewhat troublesome to use and a little prone to get out of order, the most satisfactory means of testing our bonds. In using this instrument it is necessary to be sure that all joints in the apparatus are perfect, that the contact wheel is free from oil, and that the track contact knives are sharp. These should be of very hard steel, and concaved on an emery wheel in the shop before starting out, and sharpened by means of a carborundum stone once or twice an hour when in use. The speed of the make and break mechanism is important, the ear being more sensitive to the higher pitches. We have found that with care an ordinary car may be used without special arrangements to furnish current for the tests. The best time can be made if one man makes the measurements and keeps the record, while another finds the joints and applies the contacts to the track. The "Roller" tester gives perfectly satisfactory results. It requires for rapid work somewhat more current in the rails, and requires a little more time to apply to the track.

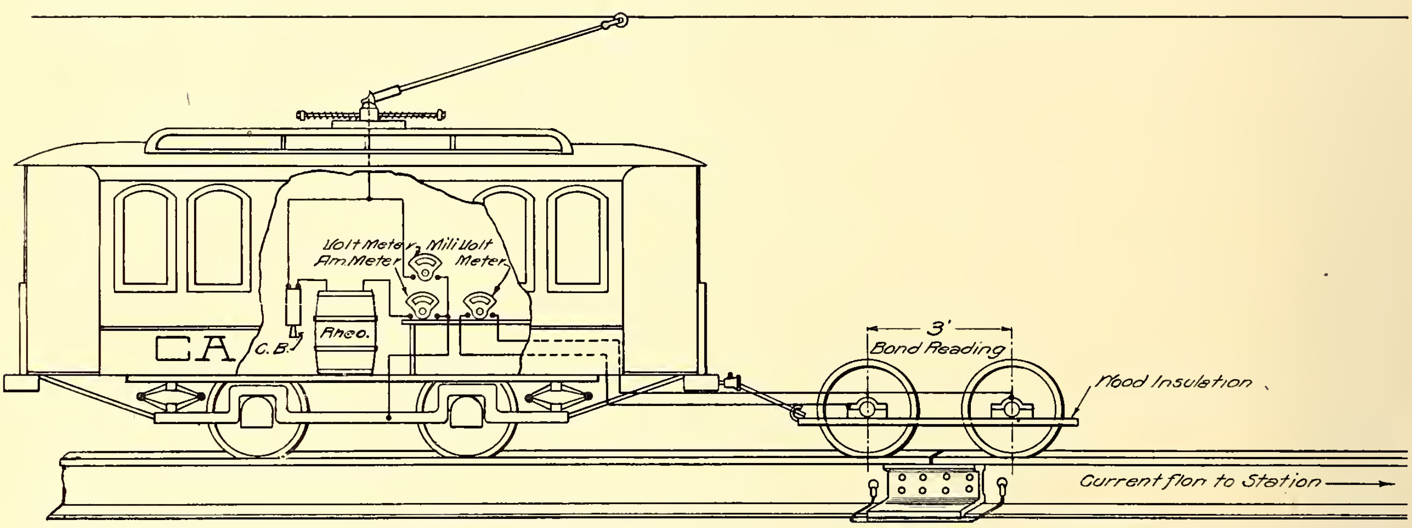
Samuel P. Hunt,
Manchester Tract., Light & Power Co.

For ordinary rail-bond testing, we use Conant T-pole rail-bond tester. We, however, make a series of tests at intervals by a trailing truck, as shown in attached sketch. Readings are taken of the resistance of each bond, and also of the ratio of conductivity of the bond to 3 ft. of rail. The bonds designed by us and known as C. & S., Nos. 1, 2 and 3, have shown remarkable efficiency. We are now using these bonds as standard on our road. They are costly, but the results obtained warrant the expenditure. Their total cost for labor and material is $1.50. This bond was described in the Street Railway Journal for Dec. 5, 1903.

P. Ney Wilson, Supervisor,
Public Service Cor., So. Jersey Div.

We test bonds with Weston milli-volt meter, comparing drop around bond with section of rail.

John A. Beeler, Vice-Pres. & Gen. Mgr.,
Denver City Tramway.



APPARATUS FOR TESTING RAIL-BONDS, SOUTH JERSEY DIVISION, PUBLIC SERVICE CORPORATION

F2.—What is the best method of keeping records of individual rail-bond tests?

We do not keep any record of individual bond tests. In testing a piece of track we mark joints which show too much resistance and follow this with a gang, which restores the damaged or broken bonds. E. D. Reed, Engr., Scranton Ry. Co.

Have span on center poles numbered, card index the line, graphically indicate the location of the pole and rail-joints and record type of bond, and when placed. During tests enter drop in pencil figures at each joint on diagram.

John A. Beeler, Vice-Pres. & Gen. Mgr., Denver City Tramway.

We have used for making records of our track joints an ordinary engineer's note book, ruled in small squares. The rail-joints can be indicated by two parallel rows of dots in proper relative position to each other and to circles indicating numbered poles along the track. The record can be made in hard pencil at the time the inspection is made, and ample space may be allowed for the entry of joint resistance, date of repair, etc. The special work may be easily sketched on a little larger scale if desired. Samuel P. Hunt, Manchester Tract., Light & Power Co

WRINKLES

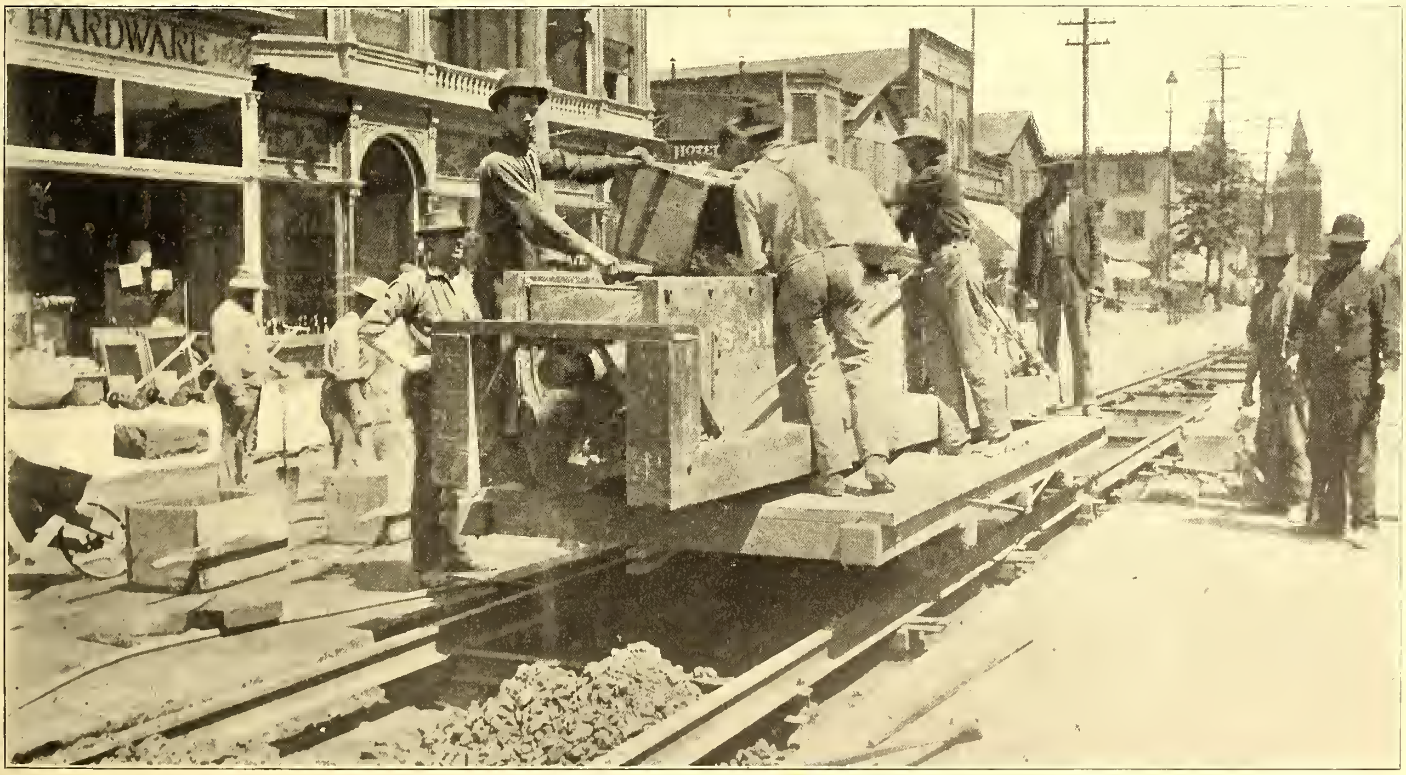
F6.—What means, machines, devices, or special-rigged cars are you using for expediting or cheapening the work of the track department? Please send description and sketch or photograph if possible.

For cheapening the work of our track department we have several devices which have been very successful. Photographs of a stone crusher mounted on a car and a concrete mixer mounted on a truck are reproduced herewith. We also have a solid cast-iron roller weighing 5 tons mounted between the wheels of an old single truck. This roller is used for rolling brick pavement and stone or earth filling between rails of track.

The portable crusher has a capacity of 50 yds. output in 10 hours, running at 300 r. p. m. The crusher is driven by a No. 3 Westinghouse car motor by means of a 6-in. belt, and the car upon which the crusher is mounted is driven by two No. 3 30-hp. Westinghouse motors. The capacity of the car is 6 cu. yds., and the weight of the crusher is 7000 lbs. The crusher will receive stones 8 ins. x 14 ins.

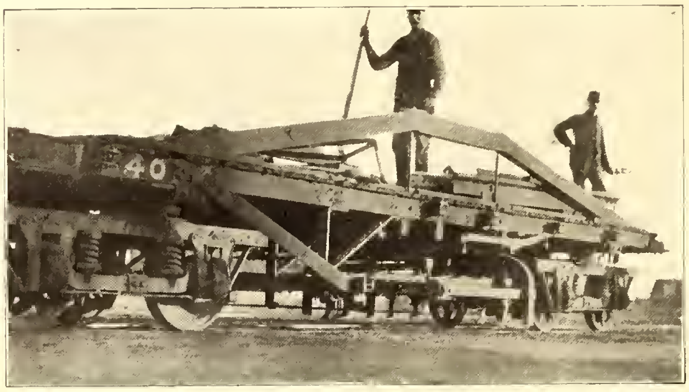
The concrete mixer comprises a Drake standard single-shaft mixer mounted on a flat car. The machine will mix 200 cu. yds. of concrete per 10-hour day. The gear is driven by a No. 3 Westinghouse car motor mounted on the frame of the mixer. The frame is mounted on a pivot and small truck, so balanced that it can be easily turned in any direction. The action of the mixer is continuous. Power for the driving motor is taken from the trolley wire by a portable pole. The car itself is moved by hand. E. D. Reed, Engr., Scranton Ry. Co.

PORTABLE CRUSHER, SCRANTON RAILWAY



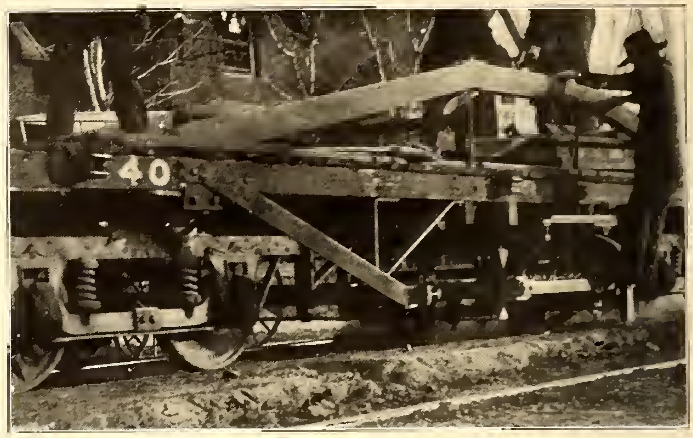
PORTABLE CONCRETE MIXER, SCRANTON RAILWAY

The accompanying photographs show a track gang plow, intended for the purpose of plowing dirt down to the tops of ties in order to more economically take care of an extensive job of disintegrated granite surfacing, under way in Denver last year.



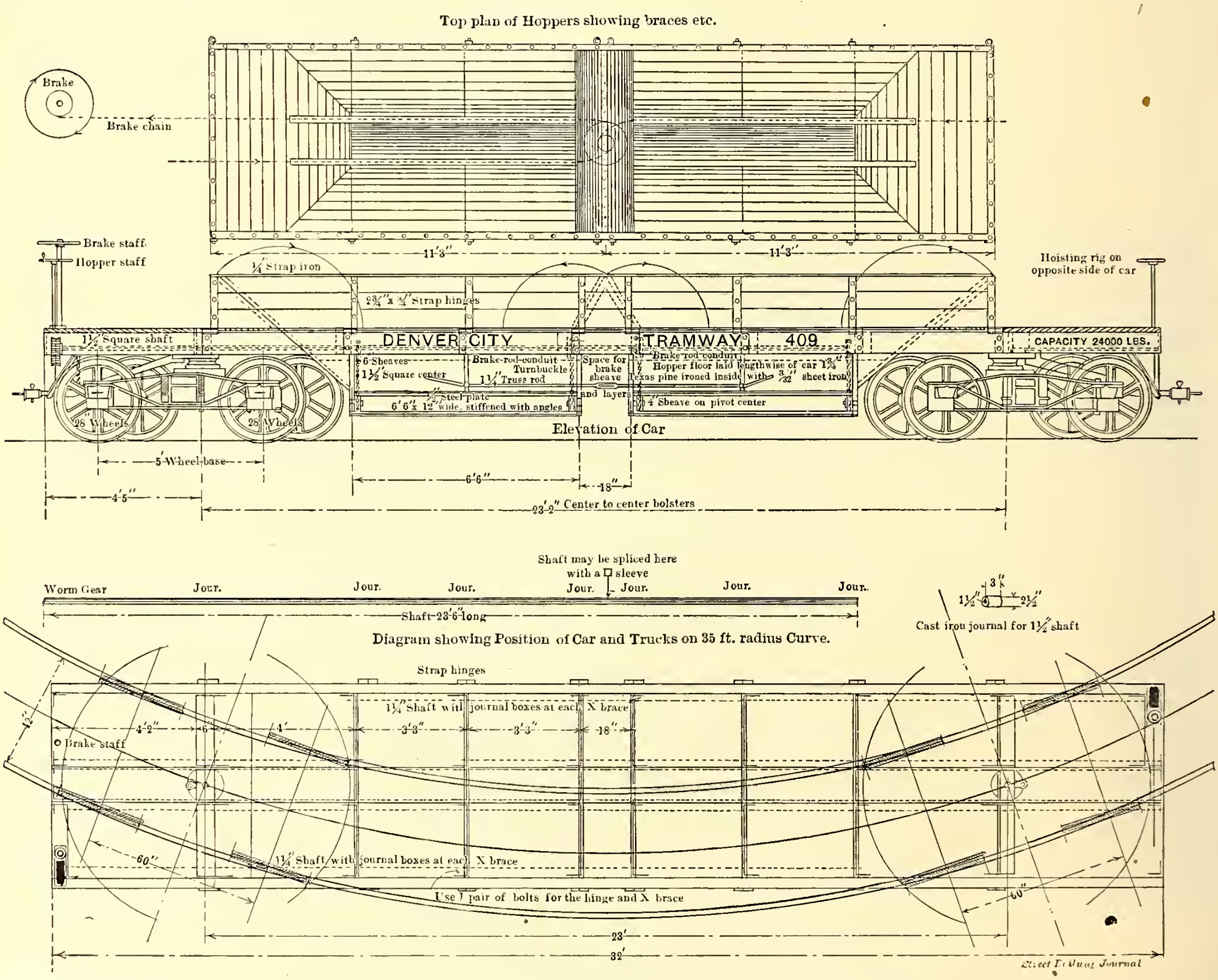
TRACK PLOW, WITH PLOW RAISED, DENVER CITY TRAMWAY

The plow is constructed "V"-shape, and is hung under a 28-ft. flat car, between the trucks. The plow has seventeen beams and cast steel points, the draught of front "V" being which is connected to arms and shafts under the car floor. The lever also serves to hold the plow down when in use. The plow is hung on stationary pieces of T-rail under the car floor,



TRACK PLOW, WITH PLOW LOWERED, DENVER CITY TRAMWAY

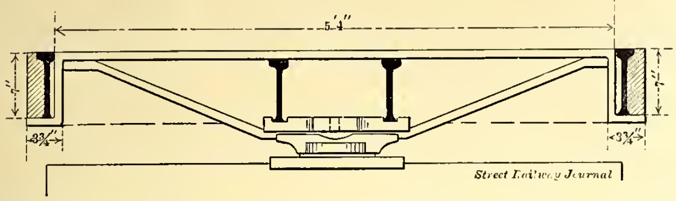
with sliding jaws fitting around the ball of the rails, to allow the plow to be moved from one side of the car to the other, so as to plow between the rails and 4 ft. outside of either rail.



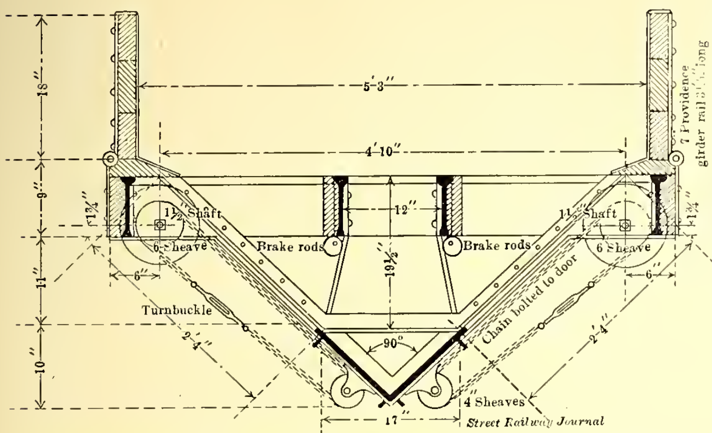
COMBINATION FLAT AND DUMP CAR, DENVER CITY TRAMWAY

stationary, with jaws to receive the ends of beams. The back "V" also has jaws to receive the back ends of the beams. The plow is raised and lowered by means of a lever on top of car, The seventeen beams and points are spaced 5½ ins. from center to center, so that one point will be directly over each rail on a 42-in. gage track. The point over each rail can be removed, and a scraper put in its place to clean the dirt from the rail. The steel points are fastened to beams in jaws with pins so they can be easily removed.

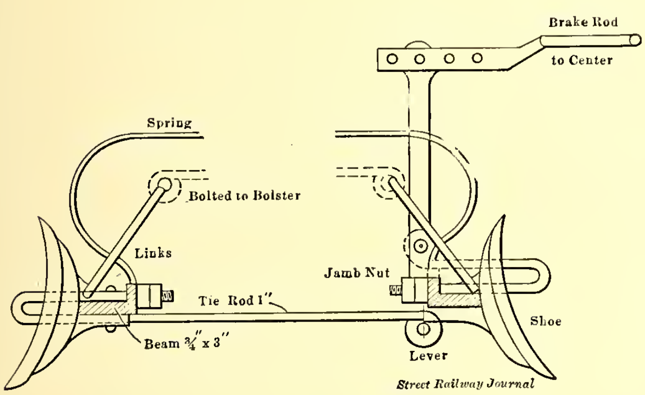
The accompanying drawing and photographs show a center



SECTION THROUGH BOLSTER, DENVER COMBINATION FLAT AND DUMP CAR



SECTION THROUGH HOPPER, DENVER COMBINATION FLAT AND DUMP CAR



BRAKE MECHANISM, DENVER COMBINATION FLAT AND DUMP CAR

COMBINATION FLAT AND DUMP CAR, DENVER CITY TRAMWAY

dump-car built by the Denver City Tramway Company. The car is built so that it can be used as a flat car when not in use as a dump-car, by removing the slide boards and placing them over the hoppers to form the floor of the car. The doors in the bottom of the hoppers are of boiler plate, and are raised and lowered by means of shafts running to the end of the car, where a reversible ratchet and lever serves to turn the shaft.

The drawing shows a worm gear and wheel which was found to be in the way at times, when using the car as a flat car. The lever drops below the surface of the floor. The sliding doors open and close at will, so that part of the load can be let out, then closed again. It is found very convenient for ballasting and surfacing track.

John A. Beeler, Vice-Pres. & Gen. Mgr.,
Denver City Tramway.

DISCUSSION ON CARS FOR CITY SERVICE AT CHICAGO

"The best car for city service" was the subject discussed at the regular meeting of the electrical section of the Western Society of Engineers, held in the Monadnock Block, Chicago, Jan. 26. In the absence of B. J. Arnold, who was unavoidably detained and who was expected to act as chairman of the meeting, George A. Damon took charge of the meeting.

Mason B. Starring, vice-president of the Chicago City Railway, was the first speaker. Mr. Starring confined his remarks to the new passenger car of the Chicago City Railway, of which a complete description was given in the Street Railway Journal for Sept. 16, 1905. Mr. Starring's talk was illustrated with lantern slides, showing the more important features of the car. The car, it may be remembered from the description referred to, has a length over all of 45 ft. 9 ins. and a width over all of 9 ft. It is of the semi-convertible type and seats forty-four passengers. Mr. Starring referred, among other things, to the double or storm sash with which the car is equipped, the fact that the car was hitchproof, the disappearing step, the filler on top of the bumpers and other features that made it impossible for anyone to stand on the outside of the car. The seat risers, he said, had been changed somewhat since the car was originally designed. They were now made to slope in under the seat, giving more room for the heel. Straps had been omitted because of the repeated complaints against them by the "Strap Hangers' League," but this omission had brought condemnation rather than commendation, and the company was arranging to provide four straps opposite each longitudinal seat. For summer use, the end doors will be removed and the end windows will also be taken out, thereby giving the car more of the features of an open car. Concerning the width of the cars, the advisability of widening the track centers was discussed, but there were many streets on which the cars operate which are so narrow that if the distance between the tracks was increased, wagons backing up against the curb to unload would interfere with traffic.

Harvey B. Fleming, chief engineer of the Chicago City Railway, who was present, then took up the electrical details of the car. Among the several lantern slides put upon the screen by Mr. Fleming were those showing the wiring circuits, the iron conduit and the terminal or junction box for motor leads. Regarding the employment of both a fuse and a circuit breaker in series, Mr. Fleming stated that they had used a circuit breaker alone on several of their equipments and the breakers had given good satisfaction, but they thought it advisable to place the fuse in the circuit as additional protection to the motor. The K-28 controller used on the car, he said, was similar to the K-10 type, with the exception that the blow-out coil extended along the base of the fingers and that the fingers had fibre separators between them. In reply to a question of Mr. Damon as to why electric heaters were adopted, and whether or not the heater cover became objectionably hot, Mr. Fleming said that there were several reasons which influenced the decision. Electric heaters, he said, were more economical, were less liable to get out of order, and that there was no coal, ashes or dirt to contend with. There had been several complaints because of covers getting hot, but he thought most of the trouble was due to people sticking pins and nails in the heater short-circuiting some of the coils and throwing a heavier load on the other heaters. In reply to the question as to who decided on what point the heaters should be operated, he said that this was in the hands of the operating department. Sign boards were placed at starting points and terminals, indicating on which point the heater should be operated, and the conductor was held responsible for the proper position of the switch.

E. T. Munger, master mechanic of the Metropolitan Elevated, said he was interested in the type of junction box used on the car for connecting the motor leads, and wanted to know if that style of box could be used for motors as large as those on his road, which are of 160 hp. Mr. Fleming saw no reason why the same type of box could not be used with large motors if the jaws and connecting blades and other parts were made sufficiently large. In reply to a question on individual fusing of motors, Mr. Munger stated that the practice of his road was to fuse the motor circuit at the trolley shoe only. If the motor becomes grounded, the automatic circuit breaker is depended on to protect the circuit. If the breaker opens, the motorman is instructed to try the controller again, and if the breaker opens a second time, he is told to cut first one motor out and then the other until the breaker holds. Mr. Fleming said considerable thought was given to the question of the type of motor to be used on the Chicago City Railway cars, whether or not it should be of a design permitting the armatures to be removed from above or from below. After visiting several shops throughout the country, they decided on a General Electric type No. 80, which permits the lower half of the shell to be dropped and the armature taken out from below. This type, he said, had the added advantage of making repairs to the armature and field possible without jacking the car body up and removing the trucks. The decision was reached in spite of the fact that the general tendency for several years past has been toward the use of that type of motor which necessitated the armature being removed from above. He remarked further that at the present time the tendency in practice is to go back to the old type of motor which permits the armatures being taken out from below. In reply to Mr. Damon's question as to the consumption per car-mile, Mr. Fleming stated that power tests were being made on the cars at the present time. Roughly, however, the car consumed from 95 watt-hours to 100 watt-hours per ton-mile, exclusive of the auxiliary circuits. The weight of the car was about 26 tons, and the schedule required from 8 m.p.h. to 9.57 m.p.h. Regarding the success of the junction box for the motor leads, he stated that there had been but three burn-outs in these since they were adopted. Two were due to workmen leaving nails or other articles in the boxes, and the third resulted from water getting into the box. No special effort was made to follow the rules of the National Board of Fire Underwriters regarding the wiring of the cars, but after the method had been decided upon, the approval of the underwriters was obtained.

To the question of the approximate cost of the cars, Mr. Starring stated that, including freight and assembling, the cost of each car was a little in excess of $5,500.

R. F. Schuchardt wanted to know what satisfaction the company was having with the lightning arresters on the car. Mr. Fleming said that they were using the General Electric type MD arrester, and these arresters were giving good satisfaction. On some of the older equipments considerable trouble was experienced by lightning getting into the air governor and lighting circuits. These circuits seemed to act as protection for the motor circuits and the motors were not affected. A choke coil had been placed in the auxiliary lead from the main trolley on the new cars to protect the auxiliary circuits.

J. R. Cravath said that the use of the junction box marked a decided advance. Most of the schemes commonly used to connect motor leads to car cables were very trying makeshifts. He spoke favorably of the use of frosted bulbs for illumination on these cars, saying that they were not only artistic, but that they eliminated the blinding glare of the bare filament. He favored the use of reflectors above lamps when placed in rows over the seats, but added that one objection to their use was the collection of dirt upon them.

Mr. Starring stated that this was rather a serious objection to the use of reflectors; that his company had tried them, but found that the convoluted surface collected dirt, which, because of the moisture present in the air, caused it to stick and resulted in necessitating an extra force of car cleaners to remove the dirt.

Chairman Damon wanted more discussion of the storm sash which had been adopted, and also wanted to find out something regarding the best finish for the hardware. He said that on one occasion he had tried to get a gun-metal finish, but was told that such a finish would wear off in a short time.

To the first question, Mr. Starring replied that the double sash maintained a pocket of comparatively warm air between the sashes, and that the passengers did not have a cold pane of glass next to them. The heating of cars on the Chicago City system was difficult, he said, by reason of the fact that both ends were used simultaneously for loading and unloading the cars. The double sash, in general, added to the efficiency of the heating apparatus.

C. K. Mohleer wanted to know the comparative cost of hot-water and electric heating.

The cost of heating, Mr. Starring said, was not a determining factor in the selection of the method adopted. The cleanliness, the flexibility and, possibly, the insurance, and the fact that the car was a double-end one and there was no room on either platform for the hot-water heater, were all important in determining the method to be adopted.

Mr. Damon said that he had thought a great deal about a central entrance car. When at Denver he investigated the subject, and had since had a communication from John A. Beeler, vice-president and general manager of the Denver City Tramway Company, in which Mr. Beeler gave his reasons for the use of central entrance cars. According to Mr. Beeler, the conductor was most of the time near the entrance of the car and in plain view of it. The car was safer to operate and passengers are loaded and unloaded more rapidly. It also offered an open and a closed compartment. Mr. Damon thought that it would be a serious mistake if the Chicago City Council prohibited the use of trail cars. In Denver, trailers were used to a great extent. A trailer weighing about 12,300 lbs. was employed, and carried 100 passengers. The motor car alone consumed about 2½ kw-hours per car-mile. The additional consumption caused by the trailer was about 1 kw-hour per car-mile. The cost of the trailer was only about 30 per cent of the cost of a motor car. The motor cars had been operated all day long with trailers and had shown no signs of abnormal heating. Mr. Damon showed several slides illustrating designs of central entrance cars which he had considered.

In concluding the discussion, Mr. Starring stated that he had one question to ask the association. He wanted to know when and under what conditions smoking should be permitted in a double-ended car. He said his company had never been able to work out a satisfactory solution of the problem. He also extended an invitation to the association to visit the shops of the company at any time convenient to members of the association. He stated that a special car would be put at their convenience.

The Toledo, Port Clinton & Lakeside Railway has joined the agreement for the use of the interchangeable transportation now used by the majority of electric railways in that district.

THE DELAWARE & HUDSON GASOLINE-ELECTRIC CAR

In a paper presented Jan. 20, 1905, by W. B. Potter, of the General Electric Company, to the New York Railroad Club and reprinted in the Street Railway Journal for Jan. 28, a preliminary account was published of the gasoline-electric coach which was being built for the Delaware & Hudson Railroad Company by the General Electric Company and the American Locomotive Works.

The first trial run of this novel car took place Feb. 3, when a successful trip was made from Schenectady to Saratoga, N. Y., and return, over the lines of the Delaware & Hudson Railroad. During the trip several important features of this method of driving were demonstrated. While the car was not designed for high speed, the average running time was about 35 m.p.h., and several times the car attained a speed of 40 m.p.h. The smooth and rapid acceleration was most favorably commented upon by the engineers present, as was the complete absence of vibration, which might be thought to accompany the use of a gasoline engine.

This car consists essentially of a gasoline-driven electric generator furnishing current to electric motors geared to the driving wheels and controlled by a method similar to that employed in the ordinary straight electric car equipment. The car in question, shown in the illustration, is of the combination type, comprising a passenger compartment, smoking room, a baggage room, engine room, one toilet and a motorman's compartment. A complete controller equipment is located at each end of the car, the forward controller being located in the engine room, while the rear compartment is self-contained. The car has seating capacity for forty passengers, including seats for twelve in the smoking room. In general it is built on the lines of a standard Delaware & Hudson passenger coach, and is handsomely finished. Within, the passenger compartment is decorated in mahogany, with a birch wainscoting; the smoking room in quartered oak, and both the baggage and engine rooms in painted poplar. The outside of the car is painted and lettered in the standard Delaware & Hudson pattern, and Gould pattern bumpers and draw-bars are provided. It is 65 ft. long, and equipped weighs 65 tons.

The gasoline engine for this car was built by the Wolseley Tool & Motor Car Company, Ltd., of Birmingham, Eng., and is considered the most powerful unit yet constructed for this class of work; it develops 160-bhp when running at 450 revolutions per minute. The cylinders of the engine are horizontal opposed, six in number, 9 ins. in diameter, with a 10-in. stroke. All valves are mechanically operated, and the cylinders are water-cooled. Hitherto, difficulty has been experienced in starting internal combustion engines of this size, but in the present case this has been entirely overcome by using shells filled with black powder to provide the initial charge in one cylinder. On starting the engine, the shell is fired by a hand trigger, the whole being similar to the breech mechanism of a gun. Jump sparks and low-tension ignition are both provided, current being furnished to the latter by a small magneto driven from the engine shaft.

The volatilization of the liquid fuel is produced in two carburetors, which form an integral part of the engine. Each carburetor supplies three cylinders, and is equipped with two float feed chambers. The chambers are identical and are of the usual needle valve type. Very flexible arrangements are provided to govern the air supply so that it may be taken from the atmosphere or from the crank chamber, or from both, according to the conditions required. The mixture is heated to the required temperature in a small chamber, which itself is warmed by the exhaust. In all details the engine is very complete. The lubrication is especially so, being force feed for main bearings and pistons, and drip feed for all other working parts. Gasoline is stored in steel tanks beneath the car, and the burnt gases pass through the roof into mufflers, from which they exhaust into the air. The cooling system for the cylinders consists of radiating tubes, located on the top of the car. Water for cooling is contained in the engine base. For heating the car a three-way cock is provided, which by-passes the circulating water through the usual pipe heating system within the car.

The transmission is electric, consisting of a generator and standard railroad motors. Current is furnished by a 120-kw, direct-connected, General Electric, 6-pole generator, designated for 600 volts. This generator is provided with commutating poles, which in connection with the method of voltage control, permits a very flexible operating system. The advantage of commutating poles is evident when it is considered that the field excitation at starting is weak, and a large current at low voltage is required to give the necessary starting torque at slow speeds. Owing to the peculiar operating conditions of this system, the generator, while retaining the characteristics of a shunt-wound machine, is separately excited by a 5½-kw, 2-pole, compound-wound exciter working at 110 volts. This is located on top of the generator and is driven by a Morse silent chain.

PARTY AT TRIAL RUN OF THE GASOLINE-ELECTRIC CAR

The motors are two GE 69, of standard railway construction, similar to those used on the Interborough Railway, New York.

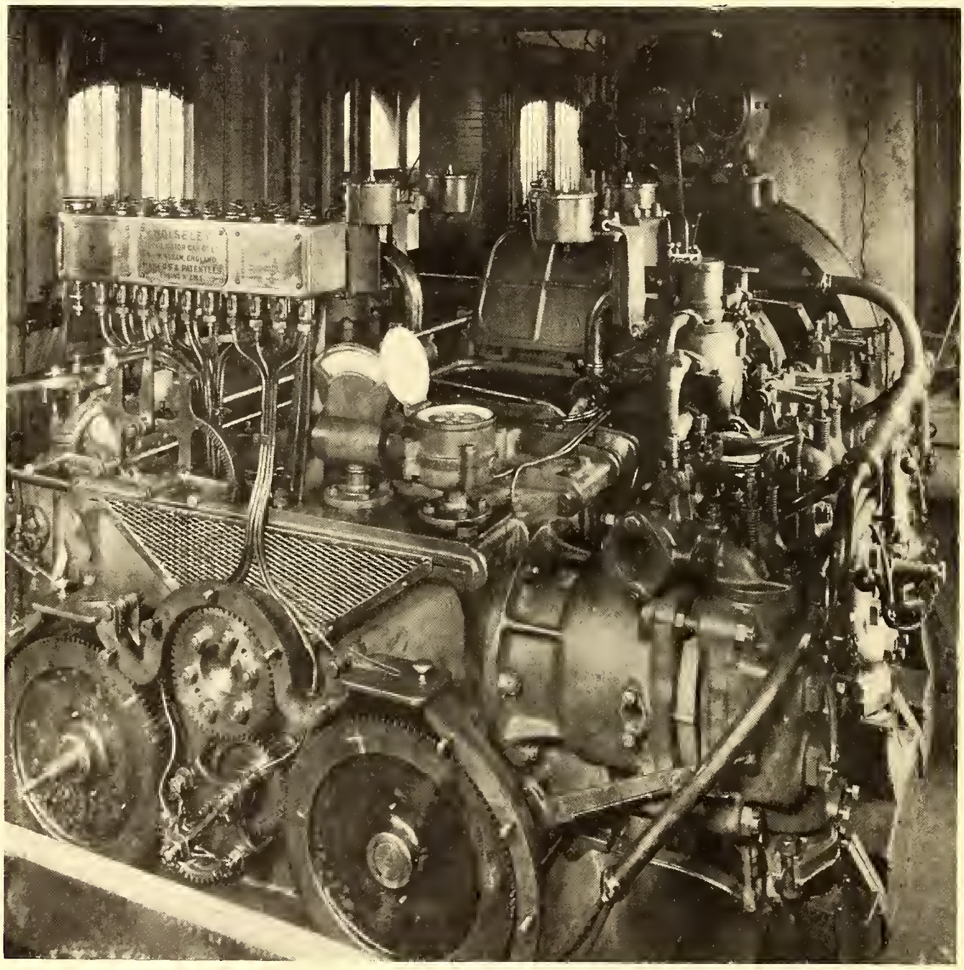
For regulating the speed of the motors, as mentioned above, voltage control is used; in other words, the speed of the car is governed by varying the field strength of the generator. With this method the speed of the engine remains constant after acceleration. The controller is semi-automatic, and can be set for any predetermined maximum acceleration. It is arranged for series-parallel control, the motor connections being changed from series to parallel by the reversing handle. This latter has five positions, "series ahead," "parallel ahead," "off," "series reverse" and "parallel reverse." Arrangements are provided to prevent the motor connections from being changed from series to parallel until the resistance is put in the field circuit of the generator.

Further operating details comprise a General Electric combination straight and automatic air-brake equipment and a special lighting equipment. The headlights are supplied with 100-cp incandescent lamps of the stereoptican type, one for each end of the car.

The trial trip of this car demonstrated the practicability of this equipment, and was entirely satisfactory to the engineers and officials present so far as the tests indicated. The opinion was expressed that this was merely a step toward the final electrification of all service. A gasoline car would be useful in establishing a passenger traffic, but eventually the motive power for operation would be electricity.

The photograph of the car on page 247 was taken after the arrival in Saratoga. Among the officials present from the Delaware & Hudson Company were Axel Ekstrom, consulting electrical engineer; J. H. Manning, superintendent of motive power; J. W. Burdick, passenger traffic manager; James McMartin, chief engineer; J. B. Dixey, assistant to second vice-president; W. J. Mullin, assistant to second vice-president; D. F. Wait, superintendent of the Susquehanna division, and E. F. Peck, manager of the Schenectady Railway Company; and from the General Electric Company E. W. Rice, Jr., technical director; W. B. Potter, chief engineer; J. R. Lovejoy, general manager of the railway department; J. G. Barry, assistant manager of the railway department; W. J. Clark, manager of transportation department; E. D. Priest, A. F. Bachelder and H. G. Chataine, of the railway engineering department, and F. H. Gale, of the advertising department.

It is expected that the car will be put in regular service between Schenectady and Saratoga.



VIEW OF THE GASOLINE-ELECTRIC APPARATUS ON DELAWARE & HUDSON CAR

MEETING OF THE EXECUTIVE COMMITTEE OF THE AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION

A meeting of the executive committee of the American Street and Interurban Railway Association was held at the association headquarters, 60 Wall Street, New York City, on Tuesday, Feb. 6, 1906. Those present were Hon. W. Caryl Ely, president of the Ohio Valley Finance Company, Buffalo, N. Y.; John I. Beggs, president of the Milwaukee Electric Railway & Light Company, Milwaukee, Wis.; James F. Shaw, president of the Boston & Worcester Electric Company, Boston, Mass.; W. B. Brockway (president of the Accountants' Association), auditor of the Nashville (Tenn.) Railway & Light Company, Yonkers, N. Y.; H. H. Adams (president of the Railway Engineering Association), superintendent of shops of the United Railways & Electric Company, Baltimore; S. L. Rhoades (president of the Claim Agents' Association), general claim agent of the Philadelphia Rapid Transit Company, Philadelphia, Pa., and Bernard V. Swenson, secretary and treasurer. Upon invitation, James H. McGraw and E. H. Baker, of the Manufacturers' Association, and W. Boardman Reed, engineer of maintenance of way of the New York City Railway Company, were also present.

The meeting was called for the purpose of considering a number of important matters relating to the American Street and Interurban Railway Association and the affiliated associations.

The secretary presented a report covering the various association matters which have taken place since the convention at Philadelphia in September, 1905. He stated that investigation had been inaugurated immediately upon the close of the convention to obtain desirable offices for the association headquarters. Temporary offices were obtained at 114 Liberty Street, and permanent headquarters at 60 Wall Street. He described the equipment for research possessed by the association and the work which had been carried on during the past few months. Circular letters relating to compensation for carrying United States mail, together with printed data sheets, were sent out in December to all electric railways in the United States, Canada and Mexico, the total number being approximately 1200. Similar circular letters were sent out the latter part of December, together with a data sheet relating to the speed of interurban cars in towns and cities. Up to the present time replies from these inquiries have been coming in continuously, and a large number is now on file in the secretary's office. Data sheets relating to the official mailing lists of the various member companies have also been sent out.

Personal typewritten letters were written to the various member companies in the latter part of December and the first part of January, outlining the work of the association as conducted under the new conditions resulting from the reorganization. In answer to this communication, the president and secretary have received a large number of letters from various railway people connected with the companies throughout the country. These letters have universally and heartily indorsed the work of the association. The association has already established correspondence with over 400 different people since the establishment of the office. More than 2000 letters have been written in the ordinary correspondence.

MEMBERSHIP COMMITTEE

The membership committee has sent out two circular letters to non-member companies, one on Sept. 15 and the other in January, 1906. These letters were in all cases signed by H. H. Vreeland, chairman of the membership committee. As a result of this work, forty-nine new companies have already joined the association, and letters are still being received in this connection.

INSURANCE MATTERS

Considerable work has been done on the question of insurance, much of which has been accomplished by the chairman of the insurance committee. This committee consists of H. J. Davies, of Cleveland, chairman, and R. B. Stearns and T. C. Penington, of Chicago. Mutual insurance companies are being formed, and it is believed that the insurance question, from the standpoint of the street railway companies, will be very materially bettered by the work of this committee.

ANNUAL REPORT

The annual report of the association is still in the printer's hands, but will be ready for distribution within a short time. The report of the Railway Engineering Association has already been distributed, and that of the Accountants' Association will be ready for distribution within a week or ten days.

RELATIONS WITH STATE AND SECTIONAL ASSOCIATIONS

The president and secretary have devoted considerable attention to the question of State and sectional street and interurban railway associations and their relation with the national association. These officers attended the meeting of the Massachusetts Street Railway Association in Boston on Dec. 13, 1905. The secretary also attended the first quarterly meeting of the New York State Street Railway Association, held at Schenectady on Jan. 10, and the president and secretary attended the first annual convention of the Central Interurban Railway Association, held at Dayton, Ohio, on Jan. 24.

THE 1906 CONVENTION

The date and location for the 1906 convention was discussed at some considerable length. Invitations had been received from Atlantic City, Denver, San Francisco, Chattanooga, Atlanta and Put-In-Bay. No definite convention city was decided upon, but the matter was left to the president, Vice-President Shaw and the secretary to investigate and report at the next meeting of the executive committee.

STANDING AND SPECIAL COMMITTEES

At the Philadelphia convention, committees on "membership," "insurance" and "rules for car wiring" were appointed. In addition to these committees, the president was authorized at the meeting to appoint several other committees, among them one on "papers and topics." This is a very important committee, and one by whom it is expected much work will be done within the next few months, as it is the desire of the executive committee to secure the presentation of valuable papers at the next convention.

OTHER BUSINESS

Among the other important matters which were considered by the executive committee was the approval of the constitutions and by-laws of the affiliated associations. These constitutions and by-laws were presented at the meeting, and, after some discussion, the matter was referred to the presidents of the various affiliated associations, together with the secretary of the American Association, with power to act.

Other matters considered related to the distribution of the proceedings for the current year, the binding of the proceedings of past years and the privileges of associate membership.

After the meeting, which adjourned at 7 p. m., those present were the guests of President Ely at dinner at the Holland House.

CITY LAND VALUES AS AFFECTED BY TRANSPORTATION FACILITIES

A most interesting address on the early history of the introduction of electric traction in New York and the opposition which the plan originally excited among real estate owners and dealers, was delivered last month by Herbert H. Vreeland, president of the New York City Railway Company, before the real estate class of the West Side Y. M. C. A., of New York. The history in New York was very similar to that in many other large, as well as small, cities, although the opposition more intense, if possible. Mr. Vreeland's account of how this antagonism gave way to a more sensible realization of the benefits conferred by modern transportation is exceedingly instructive. He said, in part:

A more vehement opposition was never raised to any improvement than that which had to be met by the advocates for the substitution of electric power in the streets of New York. They were even more violent than the riots created in London by the cabmen when umbrellas were first introduced in England from China. These London riots were based on the theory that the umbrella would destroy the cockney hacking business, and it took nearly two years to convince the outraged cabbies that they had an indestructible industry. Now that we have been enjoying for several years the benefits of rapid electrical transportation, and that it has become an hourly necessity of our daily lives, it is inconceivable that the introduction of it was ever opposed; but the truth must be told, and it is that every single step taken to bring about this great reform was opposed by real estate owners who have been most directly benefited. As a matter of fact, whole neighborhoods arose in angry protest and organized to petition the court to prevent the substitution of deadly electric-power for horse-power, on the ground that the substitution would endanger lives and limbs, destroy property values and carry away established business to other places. The records of the Supreme Court show that no less than five powerful combinations of property holders and over 100 individual taxpayers filed sworn petitions attesting their faith in the dangerous and destructive character of electric traction. It was no argument to them that the streets would not be disfigured; that the current was to be conveyed under ground; that the system had been used elsewhere, and was known to be safe and reliable. They prayed, nevertheless, to be delivered from consequences, none of which ever resulted or could possibly result. Each separate case and each new objection—one was invented every day or two—had to be formally answered in court as gravely as though it had great merit. Only the patience and sagacity of the promoters secured this great boon to the city.

I doubt if I would quote New York's experience if it was peculiar to New York alone. The experience, however, was practically universal. Much the same thing happened in a smaller way in other communities where conversions were made, and I rehearse the fact here for the purpose of bringing before you an interesting historical fact and introducing the point which will be the burden of what I have to say concerning the intimate relations between street railway improvements and real estate values. I am happy to have an opportunity to tell this little bit of history to you, for in your turn and at your time you may have a chance to spread such light as I can throw on the subject. Not all of you are to remain and labor in New York, and in the course of time you will scatter here and there into other communities where just such questions as have already been settled here will arise, and if you bear in mind the experience of history, every one of you may have an influence of great public good, and public good agreeably associated with personal and professional profit. The contests of which I speak are too remote and the success of the reforms have been too great to leave me open to the inference of complaining, and if I can free your minds from an inclination so to charge men, the road is open to point out to you how the business of transportation bears beneficially on the rental value of land of all kinds, whether it be used for farms, factories, residences or business structures.

I take it that no argument is necessary to convince any one of you that to a fertile and isolated valley nothing could be a greater blessing than a means by which it is to be populated and put into communication with the outside world and its teeming markets. State that such a region is to be open for settlement to man and a means provided for quickly transporting the products of his labor in the field or factory to open markets, and you have the unanimous consent to proceed, and all men agree that it is a beneficent thing to do. No one for a moment doubts that the furnishing of such means would immediately enhance the value of the land in the valley. It goes without saying that it would, and no argument is necessary. When the same conditions are compressed within the limits of a town or city and you have the same problem in miniature, the whole aspect of the thing seems changed and the effort to bring the various regions of a restricted place into easy access and afford citizens the means of coming and going, is under denunciation as a grab for fraud and a public outrage generally.

I think I ought, before proceeding, to point out to you certain radical differences between steam railroads and the street surface railroads. In the case of steam railroads, the roadbed, and usually a considerable space on either side of it, is owned in fee by the railroad company. A great new highway is created for the exclusive use of the steam railway, from which every one is excluded on peril of being charged with misdemeanor, and various penalties are prescribed for obstructing or interfering with it in any way. To create new highways in crowded cities through masses of monumental architecture in which millions have been invested is, of course, out of the question, and as a result railroad improvement in cities is for a more intensified use of existing highways, and not for the creation of new ones. So that it comes about that contemplated improvements, like those, are denounced and opposed as I have described; and the general public has been slowly educated to the view that the introduction of a street railway on a city thoroughfare is a misuse of the people's property, whereas in truth and in fact, the only hope of profit that its promoters have is that it will accommodate hundreds of thousands of people and facilitate access to and from the particular neighborhood into which it goes.

A foreigner, unfamiliar with our habit of editorial exaggeration, and accepting at face value what is uttered in print, would, on reading the ordinary comment concerning surface railroad extension, believe that a railroad proposed to seize an ancient highway and forthwith deprive the public of its use. When you explain to him that what is really proposed is only an added usefulness to an existing thoroughfare; that it was proposed to give the people of small means equal privileges along the highway with those who ride in cabs, carriages, automobiles, delivery wagons, bicycles, perambulators and what not else, he is puzzled to reconcile the comment with the facts. However, his mystification is no business of ours. Let him work it out for himself, while we get back to the topic in hand, the influence of transportation on the rental and taxable value of land.

When I came to the consideration of this subject, which was new to me, I assumed that on a question of this importance there existed and had been collated a mass of facts and figures which, when examined, would throw considerable light on the topic we have in hand. I inferred that from this data it would be possible to answer two questions: First, what is the effect, good or bad, of railroad improvement on land values? and, second, to what extent has this influence been felt? I found to my surprise, however, on investigation, that no such data exist in collected form, and it was in truth the discovery of this fact that finally put an end to my hesitation in favor of coming to speak to you. Because, if you carry away from this conference nothing more than the knowledge that all archives are barren of figures and facts on this important topic, it will not have been in vain, for it will have brought intimately home to your consciousness the necessity of just such work as has been undertaken in this lecture course. It will show you the necessity of an organization of this kind which can collect, discuss and collate data of this kind and make them available for those who intend to devote their time to the real estate business.

Perhaps the simplest way of illustrating what I have in mind is to quote certain examples. Let us therefore take a look at Thirty-Fourth Street and see what happened there within the past few years.

THIRTY-FOURTH STREET

In discussing this particular thoroughfare, I will exclude its east and west termini, as they are too far away from the intersecting points of these great north and south lateral lines running the length of the island, and I will confine myself to that portion of the street between Eighth and Fourth Avenues. Ten years ago this portion of Thirty-Fourth Street was among the most fashionable residential sections of the city, and its occupants had sufficient strength to postpone for many years the introduction of a crosstown line through it, notwithstanding the fact that there was a clamorous public demand for cheap transportation across town at some point between Forty-Second and Twenty-Third Streets. The promoters of the road finally succeeded in meeting the demand and beating down local opposition. Thereupon the street went into the transitional stage and the values of the residences owned by the original objectors soon began to change for the better, although the uses to which the land was to be put was for business more than for residential purposes.

By means of transfer to north and south lines intersecting this Thirty-Fourth Street railroad, the street was thrown into communication with the whole of Eighth Avenue, Seventh Avenue, Sixth Avenue, Broadway, Fourth Avenue and Lexington Avenue, so that broadly considered, that little strip of Thirty-Fourth Street was as if it had been inserted into each of those great north and south thoroughfares. Presently the line was so overtaxed that it was necessary to change the motive power, and on Aug. 28, 1900, cars propelled by electric storage batteries were introduced there. It was supposed that this improved power would ease the congestion made by the passenger contributions from these great avenues, north and south, but the tide of travel swamped the cars, and on Sept. 10, 1903, the owners of the road converted it to the underground electric system.

In the year 1900 property in this section sold at the rate of from $2,000 to $2,500 per front foot, but immediately after that date a very sudden rise took place, and R. H. Macy & Company paid for some of their land on that thoroughfare as high as $133 per square foot, or about $16,000 per front foot. On the corner of Broadway and Thirty-Fourth Street, I am informed, they paid $333 per square foot, and this in a section uninfluenced by any other than mere surface transportation, because for over twenty-five years the elevated in the immediate neighborhood, one block south, had failed to affect values at all.

Directly opposite the Macy corner, at the Sixth Avenue intersection, is the Broadway Tabernacle. The trustees of that church in 1857 bought ten lots on the northeast corner of Thirty-Fourth Street for $78,500, and disposed of four of them for $33,000, making the actual cost of that site $45,000. Within the past three years this property, which cost them $45,000, was sold for $1,275,000, and real estate men inform me that this rise was not a speculative one, but was reasonable, because of the accessibility of this site, on a corner from which four lines extending over some 500 odd miles of city streets transfer.

Opposite the Macy site there is another, that now occupied by Saks & Company. The syndicate that built this structure, which came into existence after the facilities on Thirty-Fourth Street had been fully developed, paid $133 per square foot in some instances, and the tenant of the property is under an annual rental of $170,000. A Chicago merchant, I am informed, has made an offer to the owners of this property of $3,750,000, agreeing to take it subject to a mortgage of $2,000,000 at 4½ per cent, and pay $1,750,000 in cash for their equity. The owners, believing as everyone does who studies the transportation problems of this city, that it is worth more, have fixed their price at $4,250,000, so the neighborhood seems still to be growing.

Rents in the block between Fifth and Sixth Avenues are naturally estimated upon the value of the land. Nos. 43 and 45 West Thirty-Fourth Street, dwelling houses, on a plot 50 x 98.9, have been rented to a tenant for a term of years at an annual rental of $24,000, with taxes and repairs. This same property rented in the early nineties for private use for $3,000 and $3,500, respectively.

Finally, probably the most important result of the great increase in values on Thirty-Fourth Street property, is the benefit derived by the city from increased taxes, part of which, at least, is in consequence of the excellent surface car facilities. The taxes on the following properties on the north side of Thirty-Fourth Street have increased as follows:

	Taxes 1894	Taxes 1905	Net Gain
Between 7th and 8th Aves........	$6,686.55	$22,684.18	$15,997.53
Between 7th Ave and Broadway...	2,557.60	15,261.35	12,703.75
Bewteen Broadway and 5th Ave...	29,015.00	75,710.37	56,695.37
Between 5th Ave. and Madison...	9,057.40	19,093.30	10,035.90
Between Madison and 4th Aves...	6,873.60	9,794.58	2,910.98
Total increase	......	......	$98,343.53

116TH STREET

Prior to 1895, 116th Street, between Pleasant and Manhattan Avenues, was improved only to a small extent, and at that time dwellings and apartments were erected without the remotest idea of the street ever becoming a business thoroughfare. But on April 12, 1896, the 116th Street crosstown car line was established from Lexington Avenue to Columbus Avenue and 109th Street. This was the beginning of a great change in that street, for since that time, or at least within the last five years, buildings which have been erected have stores at least on the first floor, and in many instances, one, two and three-story taxpayers, for business only, have been erected. Many of the old type five-story apartment houses have also been altered into stores and offices, at least on the first floor, and this has been more extensive than most people realize. Over 225 stores have been added by this transition. Where the alteration of apartments into stores has not taken place, many of the old private residences and first floors of apartment houses are now used by tailors, dressmakers, milliners, doctors, dental parlors, clubs, schools, etc. Another noteworthy change is that of tearing down old private residences and replacing with large elevator apartment houses with stores, the value of the land having increased so rapidly that owners can easily afford to do so. This is plainly shown, for wherever a crosstown surface line is put through a wide street it almost immediately starts a great change from a resident to a business section, and real estate values in all cases rise rapidly, as stores command a much higher rent than apartments. Rental values have been greatly increased, and 116th Street is becoming more and more a business thoroughfare. Of course, these changes do not occur in a day. They are gradual, but are, nevertheless, the more certain. The fact that so many of these alterations have taken place in so short a time signifies that the change is yet in its infancy. As 125th Street, a much older business street, has the advantage of a car line from river to river which 116th Street has not, it cannot be expected that the change effected in 116th Street shall equal that of 125th Street. Business seldom precedes a surface line, but it is very noticeable that in sections where there has been little or no business activity, after the establishment of a surface line, flourishing business and increased real estate values ensue. Therefore, every surface line is a decided boon to the public as well as real estate holders—so the more surface lines we have, the better.

125TH STREET

One Hundred and Twenty-Fifth Street is indisputably *the* uptown business center, where merchants in all lines have located, and they will never regret it either, for they are amassing fortunes. Why is this? Why, just because you can easily reach 125th Street from anywhere. The surface lines will transfer in every direction, be it Harlem or Washington Heights, and the service is excellent, too. One Hundred and Twenty-Fifth Street has not only become a business center, but, peculiarly enough, also an amusement center. Now, what effect has all this had upon the value of real estate on or about this thoroughfare? Well, just so much, that property has doubled and trebled so within the past ten years, that to-day real estate on 125th Street is worth about $4,000 per front foot, and, in consequence, rents are extremely high. But even at these high rentals, there is never a scarcity of willing and anxious lessees, and if the congestion and demand continues, there is no telling what the rents will be. Let us consider the rental conditions existing on 125th Street: To begin with, leases made this year are considerably higher than ever before. One store, 50 ft. x 100 ft., was leased for twenty-one years at a graduating rental of $14,000 to $16,000 per annum, and the lessee sub-let to a Boston shoe merchant half of the store, 25 ft. x 100 ft., at a graduating rental of $11,000 to $13,000 per annum. About the same time the southwest corner of Seventh Avenue was leased for twenty-one years at $13,000 per annum. A 50-ft. store, which five years ago rented for $7,000 per annum, now finds a ready market at $15,000 per annum. This great increase in rentals in so short a time is almost unparalleled, and is almost wholly attributable to the excellence of the surface transit facilities.

LEXINGTON AVENUE

In conclusion, I must, in order to complete my story, give you the history of a north and south line. The values of no avenue suffered more than did those on Lexington by its proximity to Third Avenue, which was the principal business thoroughfare of the east side. Beginning as Lexington Avenue does at Twenty-Second Street and Gramercy Park, in a section where there is no special business activity, and ending in the midst of car houses and factories, its possibilities as a thoroughfare were small, but by the opening of a surface railroad in 1895, a great change took place. Residents of West Harlem were enabled to reach any part of the east side as far south as Twenty-Third Street without change of cars, which naturally brought to this avenue people who would probably not have visited it under ordinary circumstances were it not for the Lenox Avenue extension. Stores which until the advent of the new road had lacked tenants were rented and business places already established were enlivened by the increase of visitors. It is significant that for some time prior to the opening of the road there had been no attempt to improve available property on the avenue with stores; but after work was commenced there was a movement in many sections toward such improvement, since which time many operations have been completed of buildings which contain stores, for which tenants were easily secured; and in numerous instances old dwellings, from which the owners derived little profit, have been altered for business purposes, and are now showing their proprietors substantial returns. These conditions are matters of record.

Though Third Avenue still retains a place as a great business thoroughfare, it will be noticed that a better class of stores, and stores that yield more to their owners, are on Lexington Avenue.

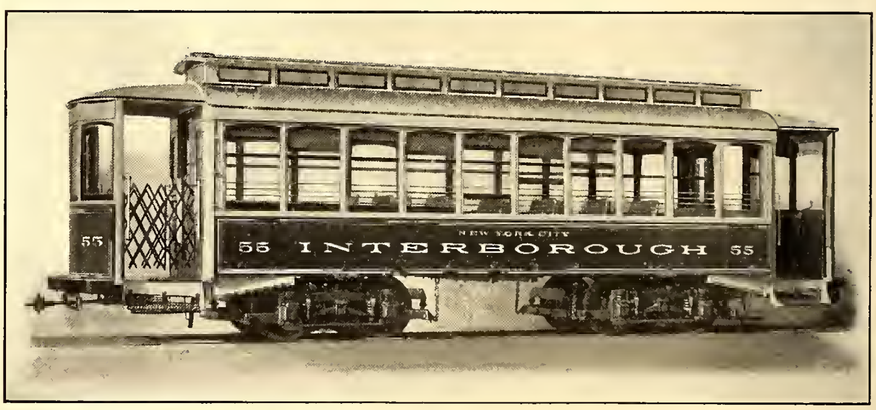
SEMI-CONVERTIBLE CARS FOR NEW YORK CITY

The New York City Interborough Railway Company has lately placed on its lines in the borough of Bronx ten grooveless-post, semi-convertible cars like the one shown in the illustrations, which were built by the J. G. Brill Company. The railway lines in the borough of Bronx were laid out primarily

INTERIOR OF SEMI-CONVERTIBLE CAR FOR NEW YORK

as feeders to the elevated roads and the subway, but considerable local traffic is also handled, as this section has developed to a remarkable extent, and has its own shopping district and business center. The company's system north of the Harlem River covers the lower half of Westchester County, embracing Mt. Vernon, Yonkers, New Rochelle, Mamaroneck, White Plains and Tarrytown. Bronx Park, with its fine zoological and botanical gardens, and Van Cortland Park, with its public golf links, are reached by the lines, and many persons use the cars in fine weather for the pleasant rides through the suburban towns which are along the Hudson River and Long Island Sound.

The form and dimensions of the bottom framing and upper structure of the cars are what the builders consider to be the standard for the length of 28 ft. over the body, with the exception of the straight sides and the fact that the platforms are 5 ft. long instead of the usual, 4 ft. 8½ ins. The extreme length of the car is 39 ft. 8 ins.; extreme width, 18 ft. 3¼ ins.; width over the posts, 8 ft., and height from rails to top of roof, 11 ft. 11 9-16 ins. The grooveless-post, semi-convertible window system is too well known to need description, and as the illustrations show the details and general appearance of the type, it is needless to repeat them. Attention, however, is directed to the long transverse seats and wide aisle obtained in this width of car by the absence of window pockets in the side walls. The transverse seats are 35 ins., and the aisle, 22 ins. wide. The longitudinal seats at the corners each take up two windows, a plan which is being adopted by many of the large city systems which use a transverse seating arrangement. The last cars built by the J. G. Brill Company for Philadelphia, Baltimore and Chicago included this arrangement.



SEMI-CONVERTIBLE CAR FOR INTERBOROUGH RAILWAY COMPANY OF NEW YORK

The interiors are finished in cherry, stained to a dark color, and the ceilings are of birch veneer, with neat decorations. Brill step-over back-spring cane seats are used, and the platform gongs, sand boxes, brake handles, radial draw-bars, folding gates, angle-iron bumpers and other patented specialties are of the same manufacture. The trucks are of the No. 27-G-1 type, with 4-ft. 6-in. wheel base and 33-in. wheels. They are capable of a speed of 30 m.p.h.

CONSTRUCTION AND ELECTRICAL EQUIPMENT BIDS ASKED FOR NEW YORK CENTRAL TUNNEL UNDER THE DETROIT RIVER

Bids for the construction of a double-track tunnel under the Detroit River to connect Windsor, Ont., with Detroit, Mich., have been requested by the New York Central Railroad and will be opened March 8. The advisory board of engineers, which has charge of the engineering and award of contracts, consists of W. J. Wilgus, vice-president, chairman; H. A. Carson, of Boston, and W. S. Kinnear, of Detroit.

The tunnel will have a length, including approaches, of 12,800 ft., made up as follows: West approach in tunnel, 2135 ft.; subaqueous portion, 2625 ft.; east approach in tunnel, 3100 ft.; total length of tunnel, about 7860 ft.; west open approach, about 1540 ft.; east open approach, about 3400 ft.; total length of approaches, 4940 ft. The grade in the tunnel on the Detroit side will be 2 per cent, and on the Windsor side, 1½ per cent.

The tunnel will be operated by electricity, and bids for the electrical equipment will be called for about Feb. 15.

SINGLE-PHASE LINE FROM PITTSBURG TO BUTLER

The Pittsburg & Butler Street Railway Company, which plans to build an electric railway from Pittsburg to Butler, Pa., a distance of about 32 miles, has awarded the Westinghouse Electric & Manufacturing Company a contract for the equipment of its lines with the single-phase system. J. C. Reilly is president, and J. R. Buchanan, vice-president of the company. Already the local system in Butler has been taken over and a contract entered into with the Pittsburg Railways Company for the entrance of the company's cars into Pittsburg.

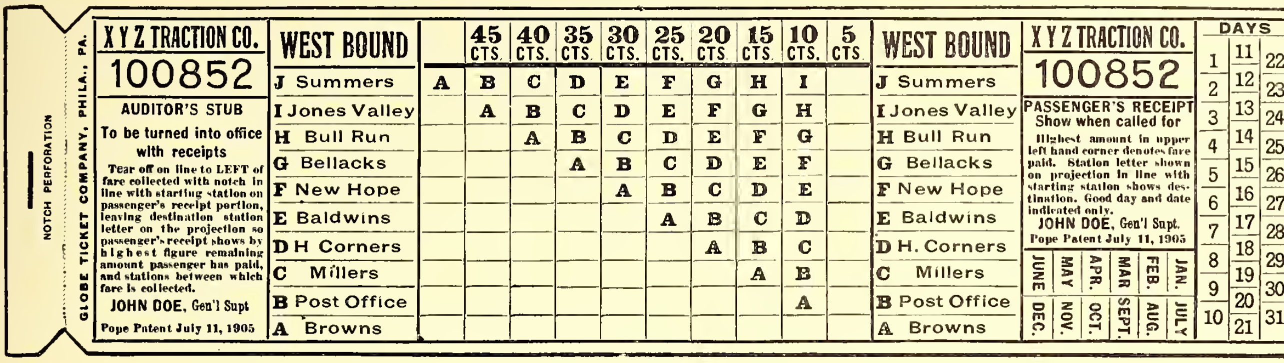
The plan for the interchange of freight which has just been put into effect upon the merged lines connecting Indianapolis with nearby cities and towns is acknowledged to be a great success. Agents have been appointed along the various lines and the advisability is now being considered of increasing the freight car equipment. From one source it is said the business has increased more than 50 per cent. An hourly service is now being given over the lines.

The Big Four Railroad Company has decided to build a 5-mile cut-off that will eliminate the prosperous town of Zionsville. The inroads made by the Indianapolis & Northwestern Traction Company on the Big Four's traffic have made it unprofitable for the steam line to maintain a station at Zionsville.

A NOVEL CASH FARE RECEIPT TICKET

Corresponding to the losses sustained by street railways from "knocked-down" fares and illegitimate transfers, the interurban railway frequently suffers from the improper accounting of fare tickets, riding beyond stations paid for, etc. To cut down such losses to a minimum, besides simplifying the work of the conductor and auditor, the Globe Ticket Company, of Philadelphia, has just brought out a new cash fare receipt ticket, designed by W. C. Pope, the vice-president of this company.

This ticket gives an accurate and absolute check on both the passenger and the conductor, the money collected and the ride to which the passenger is entitled, as well as a perfect record for the auditing department. Neither the auditor's report stub nor the passenger's receipt portion can be manipulated by unscrupulous passengers or conductors without detection. Fig. 1 shows a complete ticket, and Fig. 2 an auditor's and passenger's receipt portions of an issued ticket. For example, this ticket is shown as issued to a passenger riding on an eastbound car from H Corners to Jones Valley, the fare being 25 cents. The highest amount in the upper left-hand corner of the passenger's receipt portion shows the fare collected, and the projection made when issuing by the notched detacher, Fig. 3, shows plainly printed on it the letter I opposite the station H Corners, which is the place the passenger got on. This letter I is the station letter for Jones Valley, or the place to which the passenger has paid fare. Thus it will be seen the table automatically checks the conductor. The station letter shown on the notch projection opposite the starting station, taken in connection with the highest amount left on the passenger's receipt portion, shows by the table arrangement at a glance the amount of fare collected and the stations between which the passenger has ridden. It will therefore be seen that this novel ticket is quickly issued, easily understood and hard to beat.



NOTCH PERFORATION

GLOBE TICKET COMPANY, PHILA., PA.

XYZ TRACTION CO.

100852

AUDITOR'S STUB

To be turned into office with receipts

Tear off on line to LEFT of fare collected with notch in line with starting station on passenger's receipt portion, leaving destination station letter on the projection so passenger's receipt shows by highest figure remaining amount passenger has paid, and stations between which fare is collected.

JOHN DOE, Gen'l Supt

Pope Patent July 11, 1905

WEST BOUND		45 CTS.	40 CTS.	35 CTS.	30 CTS.	25 CTS.	20 CTS.	15 CTS.	10 CTS.	5 CTS.	WEST BOUND
J Summers	A	B	C	D	E	F	G	H	I		J Summers
I Jones Valley		A	B	C	D	E	F	G	H		I Jones Valley
H Bull Run			A	B	C	D	E	F	G		H Bull Run
G Bellacks				A	B	C	D	E	F		G Bellacks
F New Hope					A	B	C	D	E		F New Hope
E Baldwins						A	B	C	D		E Baldwins
D H Corners							A	B	C		D H. Corners
C Millers								A	B		C Millers
B Post Office									A		B Post Office
A Browns											A Browns

XYZ TRACTION CO.

100852

PASSENGER'S RECEIPT

Show when called for

Highest amount in upper left hand corner denotes fare paid. Station letter shown on projection in line with starting station shows destination. Good day and date indicated only.

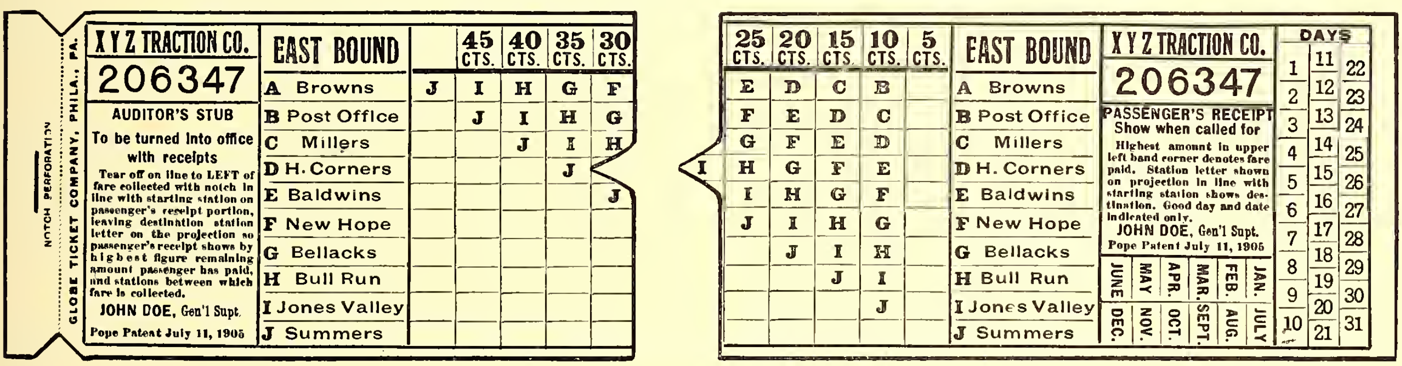
JOHN DOE, Gen'l Supt.

Pope Patent July 11, 1905

JUNE DEC. MAY NOV. APR. OCT. MAR. SEPT. FEB. AUG. JAN. JULY

DAYS 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

FIG. 1.—COMPLETE TICKET



NOTCH PERFORATION

GLOBE TICKET COMPANY, PHILA., PA.

XYZ TRACTION CO.

206347

AUDITOR'S STUB

To be turned into office with receipts

Tear off on line to LEFT of fare collected with notch in line with starting station on passenger's receipt portion, leaving destination station letter on the projection so passenger's receipt shows by highest figure remaining amount passenger has paid, and stations between which fare is collected.

JOHN DOE, Gen'l Supt.

Pope Patent July 11, 1905

EAST BOUND		45 CTS.	40 CTS.	35 CTS.	30 CTS.
A Browns	J	I	H	G	F
B Post Office		J	I	H	G
C Millers			J	I	H
D H. Corners				J	
E Baldwins					J
F New Hope					
G Bellacks					
H Bull Run					
I Jones Valley					
J Summers					

	25 CTS.	20 CTS.	15 CTS.	10 CTS.	5 CTS.	EAST BOUND
	E	D	C	B		A Browns
	F	E	D	C		B Post Office
	G	F	E	D		C Millers
I	H	G	F	E		D H. Corners
	I	H	G	F		E Baldwins
	J	I	H	G		F New Hope
		J	I	H		G Bellacks
			J	I		H Bull Run
				J		I Jones Valley
						J Summers

XYZ TRACTION CO.

206347

PASSENGER'S RECEIPT

Show when called for

Highest amount in upper left hand corner denotes fare paid. Station letter shown on projection in line with starting station shows destination. Good day and date indicated only.

JOHN DOE, Gen'l Supt.

Pope Patent July 11, 1905

JUNE DEC. MAY NOV. APR. OCT. MAR. SEPT. FEB. AUG. JAN. JULY

DAYS 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

FIG. 2.—AUDITOR'S AND PASSENGER'S RECEIPT, PORTIONS OF AN ISSUED TICKET

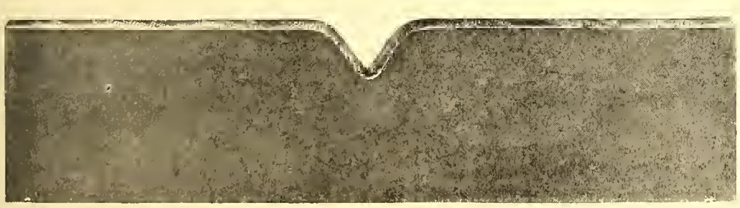


FIG. 3.—NOTCHED DETACHER USED IN CONNECTION WITH NEW TICKET RECEIPTS

SALE OF AN OHIO RAILWAY

The Cleveland & Sharon Traction Company has been sold by the Eastern Construction Company and the Cleveland & Sharon Traction Company to the Eldenbel Construction Company, of New York City. The Traction Company is in course of reorganization and will be known as the Cleveland & Sharon Electric Railway Company.

The main office will be in the New England Building, Cleveland, Ohio, and the company is now in the market for rails, ties, poles, boilers, etc. Francis B. Morgan is the temporary purchasing agent.

THE ERIE RAILROAD ELECTRICAL COMMISSION

It has been known for a long time that the Erie Railroad has been studying the possibilities of electric traction for its suburban service in the neighborhood of New York City, but that the equipment of these lines has been delayed for a number of reasons, among them the construction of an open cut in place of the present Jersey City tunnel and the rearrangement of the terminal station at Jersey City. Nevertheless, the directors of the company have recently authorized Vice-President Graham to organize an electrical commission to study the subject in detail, and it is thought that one of the branch lines, either the Northern Railroad of New Jersey or the Greenwood Lake division, will be equipped with electricity within the next year. The electrical commission, which was appointed Feb. 2, consists of the following: J. M. Graham, vice-president, chairman;

Bion J. Arnold; L. B. Stillwell; E. A. Williams, general mechanical superintendent; A. J. Stone, assistant general manager; C. H. Morrison, acting electrical engineer and secretary of the commission.

The commission will make a study of the proper system to be adopted and will report to the directors.

A NEW INSULATING MATERIAL

After experiments extending over a period of five years, followed by a series of careful and extensive tests under all possible conditions by the Electrical Testing Laboratories, of New York, a remarkably high potential insulating material, named Voltax, has been placed on the market by the Electric Cable Company, of New York. Aside from the important fact that it can be manufactured and sold at about 20 per cent less than the ordinary rubber insulation, the tests mentioned have shown that its chemical and physical properties are such as to make it well suited for the most difficult situations which an insulating material must meet. Briefly capitulated, the principal merits of this material are: lower cost; high insulation resistance; neutral chemical qualities, which make it absolutely impervious to atmospheric conditions, moisture, acids or alkalis, and consequently give indefinite retention of elasticity and insulating properties; may be subjected to severe tension and bent at short angles without affecting it in any way; will not drip under 250 degs. F.; and as it has no corrosive effect upon copper, it is unnecessary to tin the wire before applying the insulating compound.

To demonstrate conclusively the exact qualities of this material, three tests were made on four samples of wire submitted. Each wire was wrapped with a different number of layers of cotton tape impregnated with Voltax. These trials, as the following data show, demonstrated the high potential capacity, insulation resistance capacity, as well as the melting point and carrying capacity determined by the dripping of the insulating material. A notable fact in connection with these tests is that they were made on hand-taped wires, which, of course, could not be expected to give such good results as would be obtained with the machine-taped wires which the company is now able to supply. It should also be noted that all of these samples had an extremely thin wall of insulation. The material furnished by this company for commercial use can have the thickness of wall of insulation increased to such an extent that no voltage ever generated for commercial use can puncture the insulation. This can be accomplished by simply adding more impregnated tapes.

The high potential tests were made with one ½-kw, 10,000-volt transformer or more in series. In all cases the pressure was raised gradually from a low point until puncture occurred. The pressure was applied to the samples of wire between the copper and the tin foil wrapped tightly around it. The compound was melted also into sheets and tested between 1-in. circular discs just touching either surface. All the voltage values given in the following Table I. are virtual and not maximum:

TABLE I.

Sample		Volts at Puncture	Average Volts of Several Samples
No. 1.	One layer of tape—Lowest....	2,500	
	Highest	7,000	4,390
No. 2.	Two layers of tape.—Lowest..	4,000	
	Highest	10,500	8,300
No. 4.	Four layers of tape—Lowest..	27,600	
	Highest	27,900	27,750

The total insulation of the last sample consisted of four layers of impregnated tape and dry tape, measuring only 84 mils in thickness. A sample covered with six impregnated tapes and a dry tape, after being immersed in salt water for seventy-two consecutive hours, presented a resistance of 23,000 ohms, thus showing that even salt water has no effect whatever upon this insulation.

The material for commercial application will be manufactured with any desired number of impregnated tapes, covered with a jute braid, hard finish, thus adding sufficiently to the resistance to withstand any commercial voltage.

Table II., given herewith, is the record of a high potential test of two wires covered with tape impregnated with Voltax after a trial of their carrying capacity:

TABLE II.

Sample	Volts at Puncture	Average Volts
1 tape—Lowest	2,000	
Highest	2,100	2,050
4 tapes—Lowest	27,600	
Highest	27,900	27,750

The tests made on the sheets of this compound are recorded in Table III., herewith:

TABLE III.

Sheet		Volts at Puncture	Thickness	Volts Per Mil.
	Lowest	20,000	75 mils.	267
No. 1.	Highest	25,500	75 mils.	344
No. 2.		22,500*		
No. 3.		30,000	105 mils.	286
No. 4.		30,000		

* Arced over edges, but did not puncture.

With reference to the foregoing Table III., it may be added that sheet No. 3 withstood 30,000 volts for 10 seconds, while No. 4 withstood the same voltage for 1 minute without puncture.

For the insulation resistance tests a copper wire was covered with six layers of tape impregnated with Voltax and placed in salt water. Its insulation resistance was measured by the usual galvanometer method after several periods of immersion. The insulation resistance of the compound made in thin sheets was also measured. In both cases the resistance was in thousands of millions of ohms, and hence it was practically impossible to determine exact figures.

The corporation now making this compound is, as noted above, the Electric Cable Company, which was formed recently to succeed the Magnet Wire Company and the Peerless Electric Company, both of New York. Details regarding the organization of this company were published on page 219 of the STREET RAILWAY JOURNAL of Feb. 3, 1906.

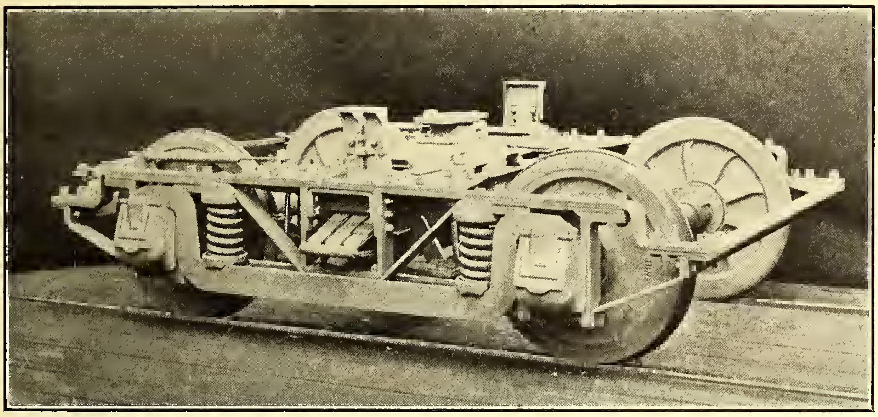
DETAILS OF ELECTRICAL EQUIPMENT FOR THE BOSTON ELEVATED

With the increased traffic on the elevated lines of Boston's street car system, it has become necessary to augment the present rolling stock. The satisfactory operation of the previous car motors bought from the General Electric Company two years ago, led to the purchase of the forty-five additional equipments from the same company. Each of these equipments consists of two GE 68, 175-hp motors with the Sprague-General Electric multiple-unit control. In addition, the present elevated cars are to be provided with similar control systems to take the place of the older type of control, and 153 Sprague-General Electric type M controllers have been bought for this purpose. Another device with which the Boston Elevated Company is about to equip its elevated system is an electrically-operated circuit breaker. This automatic switch, in addition to opening in the ordinary manner under an overload, can be set or tripped from a button in the motorman's cab. More than 175 of these new circuit breakers have been purchased from the General Electric Company.

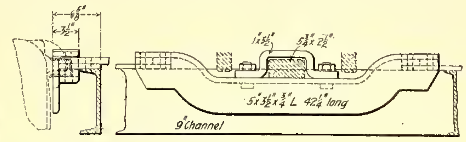
The equipment for the East Boston tunnel will also be increased. For this purpose fifty two-motor GE 73, 75-hp car equipments have been ordered. These, like the elevated equipment, will be controlled by the type M apparatus, which has proved so universally successful.

TRUCKS FOR THE ROCHESTER, SYRACUSE & EASTERN

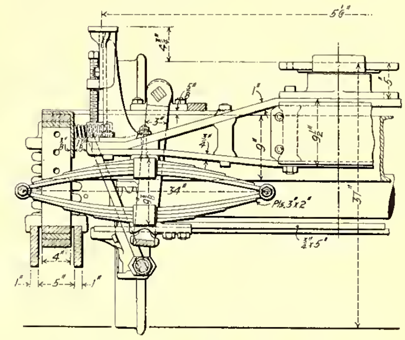
In the account of the track construction of the Rochester, Syracuse & Eastern Railway, published in the Street Railway Journal for Dec. 16, 1905, there was a short reference to the trucks and rolling stock. A side and end elevation, a cross section and side view of one of the trucks are presented herewith. The truck is interesting principally from the fact that it is representative of the increasing tendency of heavy high-speed electric lines to use the essential features of the Master Car Builders' steam railroad truck, with such modifica-



TRUCK FOR THE ROCHESTER, SYRACUSE & EASTERN RAPID RAILWAY



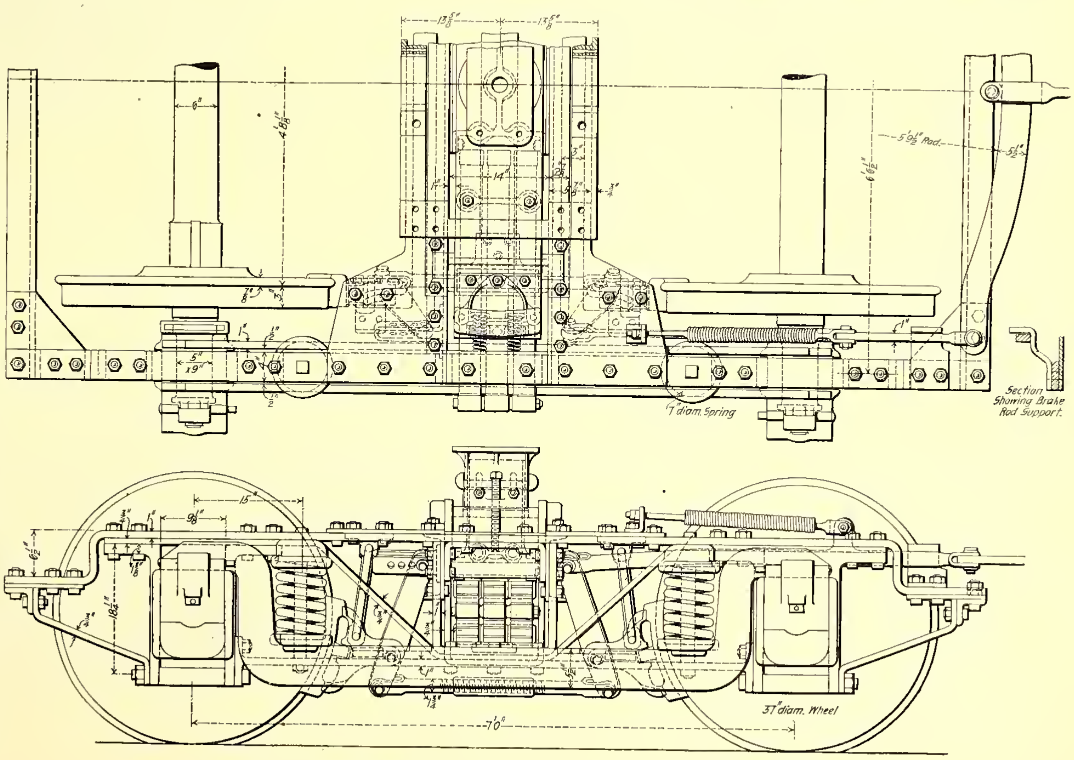
MOTOR SUSPENSION



SECTION THROUGH BOLSTER

tions as are necessary to adapt the truck for heavy high-speed motor service. The truck was designed by R. A. Dyer, Jr., mechanical engineer of the railway company, and E. G. Long, of New York, formerly with the Peckham Company, and was built by the J. G. Brill Company. It will carry two Westinghouse No. 119 motors. The trucks will carry a car body measuring 46 ft. over corner posts, 55 ft. over all, and 8 ft. 3 ins. over sills.

The entire weight of the equipment is made up as follows: Weight of trucks, 24,000 lbs.; weight of motor equipment, 21,180 lbs.; air brake equipment, 2600 lbs.; car body only, 33,000 lbs.; weight of car without load, 80,780 lbs.; average passenger load, 10,000 lbs.; total weight of car loaded, 90,780 lbs. The main dimensions of the truck follow: Diameter of wheels on tread, 37 ins.; width of wheel tread, 3 ins.; depth of wheel flange, 7/8 in.; diameter of axles, 6 ins.; diameter of gear seat on axles, 7 1-16 ins.; diameter of journals, 5 ins.; length of journals, 9 ins.; length of wheel base, 7 ft.; gage of track, 4 ft. 8 ins., and gage of wheels, 4 ft. 8 1/8 ins.



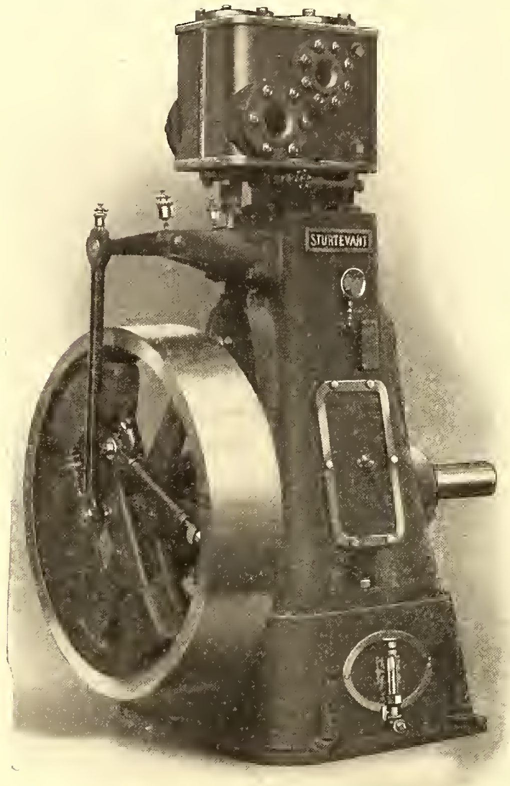
SIDE ELEVATION AND PART PLAN VIEW OF TRUCK

The truck frames are of forged steel throughout, and are composed of a top frame of steel 4 ins. wide and 1 in. thick, truss members of steel 4 ins. x 3/4 in., and lower members of steel 4 ins. x 1/2 in., for rigidly securing in position the yokes or pedestals within which the journal boxes are secured. The equalizing bars are 5 1/2 ins. x 1 in., and the ends of the frame are reinforced by heavy pieces of steel angle, which are secured to and supported by the pedestal braces.

The bolster transoms are double steel channels 9 ins. deep, rigidly secured to the top frames and truss members. The bolster is constructed of two steel members; the upper 12 ins. x 1 in., and the lower 12 ins. x 3/4 in. The upper and lower members of the bolster are secured together by bolts and braces of heavy section metal. The top and bottom center plates are of cast steel. The bolster is supported upon six full elliptical springs, three at each end. Each spring is 3 ins. wide x 34 ins. long x 9 3/8 ins. high. The coil springs, secured between truck frame and equalizing bars, are each 7 ins. in diameter x 10 7/8 ins. high, with suitable inner coils, these springs being made of proper strength to give, in combination with the triple elliptical bolster springs, a very easy riding car under all conditions of load. The brakes are of the M. C. B. type, and the brake-shoes and heads of the "Christie" pattern. The journal boxes are also of the M. C. B. pattern, except that they are made deeper, so as to hold more lubricant, and the lugs securing the bearing and wedge are stronger, to endure the increased thrust of axle due to its carrying a heavy motor.

A VERTICAL ENGINE USING FORCED LUBRICATION

The B. F. Sturtevant Company, of Hyde Park, Mass., has just brought out a line of new vertical high-speed automatic engines, known as class VS5. A system of forced lubrication and the complete enclosure of the moving parts provide for continuous operation for weeks at a time without attention, and insure perfect reliability even in the hands of the unskilled. These engines are especially designed for the driving of direct-connected generators. Lubrication for all bearings is provided by a submerged oil pump in the base. This pump is operated by the crankshaft, and acts against a pressure of from 10 lbs. to 20 lbs. per square inch. Centrifugal oil guards located on the shaft just where it passes through the casing, together with the enclosing frame and the watershed partition, insure perfect cleanliness and absolutely prevent the escape of the oil, which is continuously repumped to the bearings. Another important and distinctive feature of this engine is a watershed partition, which prevents water from the piston-rod stuffing box mixing with the lubricating oil in the case, and at the same time makes impossible the passage of oil from the enclosing frame to the interior of the cylinder. The piston-rod stuffing box may be readily adjusted without opening the case. This watershed partition forms a part of the enclosing frame, which protects the parts from dirt and accident, insures economy and eliminates the necessity of frequent attention; but the removable oil-tight plates or covers make the parts as accessible as in the open type of engine.



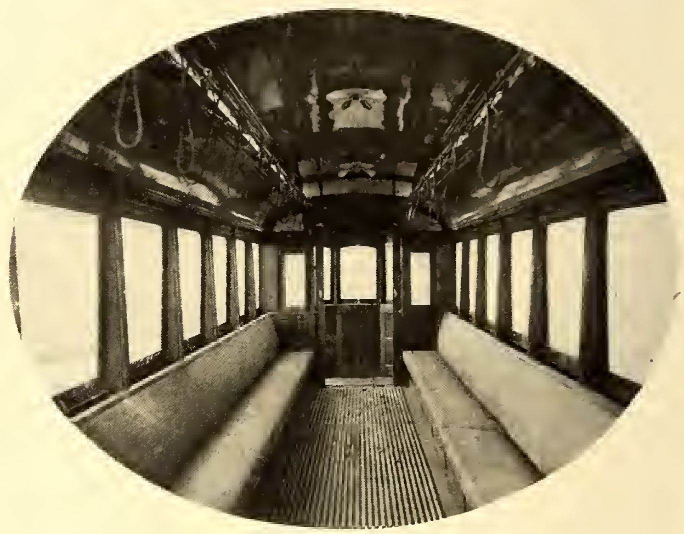
VERTICAL ENGINE USING FORCED LUBRICATION

The cylinder, with which is cast the valve chamber, is provided with relief valves, which, by opening automatically at any predetermined pressure, prevent possible damage by water. A planished sheet-iron cylinder casing enclosing a thick layer of asbestos greatly reduces condensation. The flow of steam to and from the cylinder is controlled by a perfectly balanced piston valve, the snap rings of which insure tightness, and the bushing in which it moves may be easily replaced when worn. A Rites fly-wheel governor alters the cut-off by changing the valve travel, permitting only 1½ per cent variation in speed between no load and full load. The hollow cast-iron piston, strengthened by internal ribs, is fastened to the piston rod by a forced taper fit, secured by a nut.

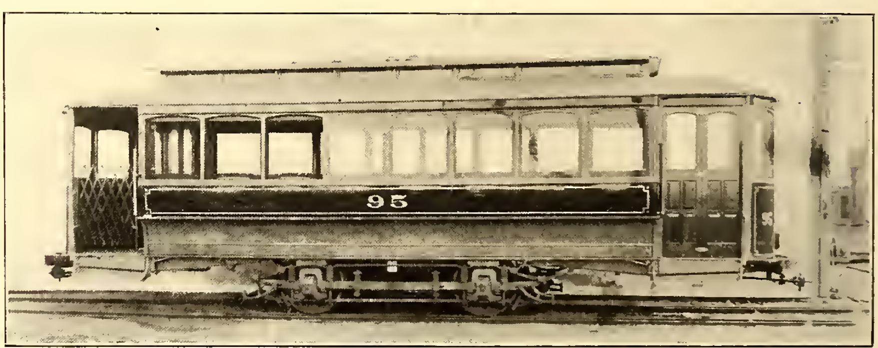
Open-hearth steel is the material from which are forged the piston rod, connecting rod and crankshaft, each from a single piece. The composition boxes of the connecting rod are lined with Sturtevant white metal hammered in and accurately bored; the cast-iron cross-head is equipped with adjustable shoes and a nickel-steel wrist pin, and the crank pin is of unusually large size.

NEW EQUIPMENT FOR THE SPRINGFIELD CONSOLIDATED RAILWAY

The car illustrated is one of a number lately delivered to the Springfield Consolidated Railway Company, of Springfield, Ill., by the American Car Company. The builders furnished to the Springfield Company a lot of cars of a similar type about a year ago, and previous to that built several convertible cars of the Brill type. The railway company now operates nearly seventy cars on its 28 miles of track.



INTERIOR OF SPRINGFIELD CAR, SHOWING LONGITUDINAL SEATING



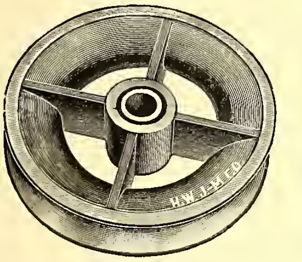
TYPE OF CAR ADOPTED BY THE SPRINGFIELD CONSOLIDATED RAILWAY CO.

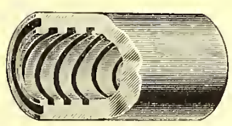
The new cars measure 22 ft. over the bodies and 32 ft. over the vestibules; width over the sills, including the plates, 6 ft. 3 ins., and over the posts at the belt, 7 ft. 5½ ins.; sweep of the posts, 7¾ ins.; distance from the center to the center of the side posts, 6 ft. 8¼ ins.; height from the floor to the ceiling, 7 ft. 11⅝ ins.; from the track to the under side of the side sills, 2 ft. 2⅝ ins., and from the under side of the side sills over the trolley board, 8 ft. 11 ins.; from the track to the platform step, 15¼ ins., and from the step to the platform, 12 ins. The side sills are 3¾ ins. x 7 ins., with 7-in. x ½-in. plates on the outside; end sills, 3½ ins. x 6 ins.; thickness of the corner posts, 3¾ ins., and of the side posts, 1¾ ins.

The seats are placed longitudinally and are upholstered in spring rattan. Cherry of natural color constitutes the interior finish, with ceilings of neatly decorated birch veneer. The bronze trimmings are of generous dimensions. The platforms are 5 ft. long instead of 4 ft. 6 ins., which is usual in single-truck cars. Folding gates are used in addition to the vestibule doors. The doors are controlled by an automatic device which prevents them from swinging free. This device is of Brill manufacture, as are also the folding gates, platform gongs, signal bells, angle-iron bumpers, etc. The cars are mounted on No. 21-E trucks, with 8-ft. wheel base and 33-in. wheels. The trucks, it is claimed, will carry these extra long car bodies at speeds of from 15 m.p.h. to 20 m.p.h. without oscillation.

PURE COPPER TROLLEY WHEELS

In the manufacture of trolley wheels such materials as arsenic, antimony, bismuth, tin, lead and spelter are frequently combined with copper, and these elements, even though used only in very small quantities, seriously affect copper as a conductor of electricity, renders the metal harder and greatly diminishes its ductility. As a result the trolley wheels cut the wire and both the wheels and the overhead construction require more frequent replacement. To obviate these difficulties, the H. W. Johns-Manville Company has recently placed on the market a new wheel made of absolutely pure copper, which is purified, hardened and made tough by a special treatment devised by this company. These wheels have been subjected to severe tests in actual service, and have, it is claimed, demonstrated their superiority over all other types. The salient feature of the J-M pure copper wheel that appeals to the operating railroad man is economy, as the mileage is stated to be far greater than heretofore obtainable by the use of any other metal or com-





TROLLEY WHEEL AND BUSHING

bination of metals. These wheels wear evenly and will not pit, arc or burn.

In the manufacture of these wheels the pure lake copper used is treated chemically to reduce to a minimum any ingredients there may be in the copper in its crude state, and by a further chemical process to exclude the action of the atmosphere. The copper is subjected to the action of carbon to remove the oxygen to render the copper solid when cast, thus increasing its malleability and durability. An additional process toughens the metal without hardening it, and the result is that the wear is reduced to a minimum and the conductivity of the wheel made equal to that of the wire.

These wheels are furnished with the J-M special trolley wheel bushings, which are made from a metal peculiarly adapted for this purpose. The tenacity of this metal is equal to mild steel, with a compressive strength of about 130,000 lbs. per square inch. Its ductility and toughness are such that it will not crack when distorted by this load. It is much harder than a gold coin, and when placed in a position where it is subjected to heat will not harden, and is therefore less susceptible to wear. These bushings are packed with a packing, which is stated to be not only anti-frictional, but also an excellent lubricant.

LONG-DISTANCE LIMITED SERVICE IN OHIO AND INDIANA

Within the next two or three months the possibilities for long-distance, high-speed travel in Ohio and Indiana will be greatly improved and trips of 200 miles to 300 miles at speed closely approximating that of the best steam trains will be made possible. A number of roads which heretofore have had connection and have operated local service only are now arranging to put on limited service in the very near future, and by mutual agreement their schedules are being arranged so that the layovers in connecting cities will be very short; in most cases they will be just long enough to insure connections. The opening of the line between Findlay and Lima has greatly increased the possibilities for this through traffic, and as soon as this new track can be ballasted the through limited service will be extended greatly. The details of some of these new services are interesting.

Beginning March 1 the Fort Wayne, Van Wert & Lima Traction Company will institute limited train service between Fort Wayne and Lima. There will be four cars each way daily, making the 65 miles in 1 hour and 45 minutes. In Lima close connections will be made with the "Lima Limiteds" of the Dayton & Troy and Western Ohio lines, which make the 80 miles between Dayton and Lima in 2 hours and 35 minutes, making possible a trip from Dayton to Fort Wayne, 145 miles, in 4 hours and 20 minutes. At Fort Wayne these cars will make connection with limited cars over the Fort Wayne & Wabash Valley and the Indiana Union Traction Company, which will make 135 miles from Fort Wayne to Indianapolis, via Peru, in 4 hours and 20 minutes.

By April 1 it is expected that the Findlay-Lima line will be in shape for high-speed service, and at that time the "Lima Limiteds" will be extended through to Toledo over the Toledo, Bowling Green & Southern. The distance from Dayton to Toledo is 162 miles, and a schedule of 5 hours and 30 minutes has been arranged for.

Within the next thirty days the Detroit, Monroe & Toledo Short Line will start its limited service between Detroit and Toledo, making the 60 miles in 2 hours. Close connection will be made in Toledo with the "Lima Limiteds," which will give a service of 7 hours and 30 minutes for 222 miles.

Before the middle of the summer the Cincinnati Northern will start a limited service between Cincinnati and Dayton, and with the schedule arranged for it will be possible to travel from Cincinnati to Detroit, 275 miles, in 9 hours and 30 minutes.

Last Saturday representatives of the Detroit, Monroe & Toledo; Toledo, Bowling Green & Southern; Western Ohio; Dayton & Troy, and Fort Wayne, Van Wert & Lima companies met in Toledo to work out plans for handling through passenger and freight business on these connecting lines, which in the future will work under an agreement known as the "Lima Route." Rates and schedules for both passenger and freight service were discussed. A committee composed of C. C. Collins, general freight agent of the Western Ohio, and C. M. Paxton, traffic manager of the Dayton & Troy, was appointed to work up necessary schedules and submit them to the various managers at a later meeting. By the agreement there will be a perfect understanding between the various roads and tickets will be sold and freight shipped to all points between Detroit, Toledo, Lima, Dayton, Springfield, Columbus, Cincinnati, Newark, Ohio; Richmond, Ind.; Indianapolis Fort Wayne, Logansport and numerous other towns in Indiana. Much of this has been done in the past, but some of the roads have had different methods of handling the business. Now the methods will be made uniform and schedules will be arranged so that fast through freight will be possible.

A NEW VARIABLE-SPEED MOTOR

The Lincoln Electric Manufacturing Company, of Cleveland, is introducing a new variable-speed motor for stationary work, which was designed by John C. Lincoln. The method of obtaining speed variation is unique in that it is obtained by withdrawing the armature from the influence of the field poles. The motor is of the ordinary shunt-wound type, the shunt-field windings being connected in series, and the armature is wound as an ordinary armature in any shunt-wound motor. Means are provided for moving the armature in and out between the pole pieces. As the armature is withdrawn the magnetic flux decreases and the magnetic resistance increases, the result being increased speed. The armature is slightly larger at one end than at the other. The use of the conical-shaped armature makes it possible to obtain a more rapid change in speed with a given lateral movement than with a cylindrical armature.

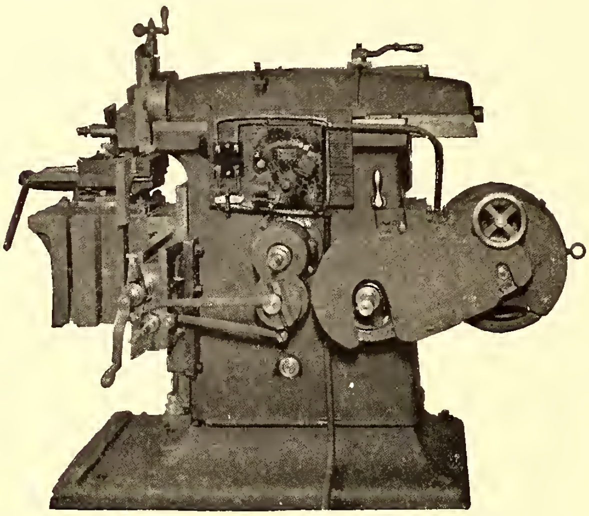


FIG. 1.—SHOWING 2-HP MOTOR MOUNTED AT SIDE OF 16-IN. SHAPER

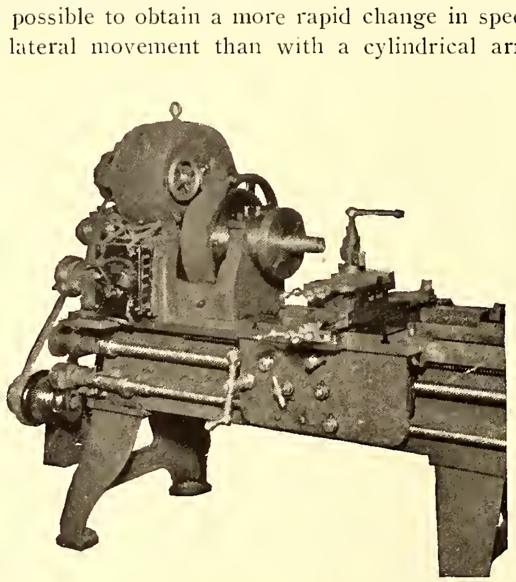


FIG. 2.—VARIABLE-SPEED MOTOR ON 16-IN. LATHE

With the conical armature the withdrawal of the armature decreases the area of the air gap in the same proportion as it would if a cylindrical armature was used, but at the same time it increases the length of the air gap, which would not occur with the cylindrical armature. Thus the increase in the resistance of the air gap is more rapid with the conical armature than with the cylindrical armature, so that a given variation in speed can be more rapidly obtained with a conical than with a cylindrical armature.

Special series-wound commutating poles are provided between the main field poles, and the armature comes under the influence of these as it is withdrawn into its positions of high speed, the result being, it is claimed, sparkless commutation at all speed and loads.

The particular advantage claimed for this type of motor over motors using the field weakening method of control is in the wide range of speed which can be obtained with this construction. A hand wheel is used in connection with a screw mechanism, and by means of this wheel it is possible to get any range of speed of which the motor is capable. This is of great advantage in machine-tool work, as the machinist can increase or decrease the speed as he desires, at the same time giving his entire attention to his work. A variation of 10 to 1 is provided on many of these motors, and a wider variation can be obtained if desired. The wide speed variation is due to the fact that there is no more distortion of the main flux at high speeds than there is at low speeds, because the full field strength is used, no matter what the motor speed may be.

The commutator end of the armature is supported by a thrust bearing. This is made solid and has ample oil space, and as it is fitted with a cap to retain the oil, it will run for several weeks without attention. The brushes are carried on the thrust bearing, and as the bearing, armature and commutator all move together, there is no relative lateral movement between the commutator and the brushes. A coil spring is used to counterbalance the magnetic pull on the armature, greatly facilitating the ease with which speed adjustments are made. On the thrust bearing is a scale on which the approximate speed of the motor is indicated.

It is claimed that at all speeds the motor can be overloaded 100 per cent without sparking, and at low and intermediate speeds it will carry for a short period even a greater overload. A special advantage is the fact that the motor will run in either direction with like results. It is built for 110-volt, 220-volt and 500-volt direct-current circuits. All speeds are obtained with one voltage from an ordinary two-wire circuit. The fields and armature coils are shaped and treated so as to provide the best ventilation and heat radiation, so that notwithstanding the small size and weight of the motor, the heating even at high speeds is well within the margin of safety. The efficiency is claimed to be very high and the capacity throughout the range is constant.

The Lincoln Company has fitted up a factory and it is utilizing its motors on a number of machine tools which were not designed for direct electric drive. Fig. 1 shows a 2-hp 5 to 1 motor mounted on a 16-in. shaper being attached at the side of the machine and connected by a silent chain. Fig. 2 shows a similar motor mounted on a 16-in. lathe and geared directly to a speed pulley, the main shaft passing through the field frame. In every case the hand wheel for regulating the speed by shifting the armature is close to other controlling levers on the machine tool, so that the operator need not move from his position or have his attention taken from his work in varying the speed.

ATHENS-PIRAEUS STEAM AND HORSE LINES TO BE CONVERTED FOR ELECTRIC OPERATION

Consul Horton, of Athens, reports on the electric tramway extension for Athens and Piræus, to be developed from the present horse and steam system by Franco-Belgian capitalists. Delay was caused in granting the new concession because of the change in the Greek ministry, all such matters having to be ratified by the Chamber of Deputies. The present 25-mile line will be transformed into a 30-mile electric line, with 60 per cent of it double-tracked. The electrical apparatus will be American pattern, manufactured in Paris by the French Thomson-Houston Company. Further information can be secured from G. Sacco Albanese, care the Greek Electric Company.

GENERAL ELECTRIC STRAIGHT AIR-BRAKE EQUIPMENT

The General Electric Company has recently placed upon the market a complete line of air-brake equipments to meet the demands of all classes of electric railway service. Owing to its close relation to electric railway development since its inception, the air-brake apparatus now offered is the result of a long experience and careful study of the requirements of electric traction service. The straight air-brake equipment combines the essential features of positive control, simplicity and ease of manipulation, and has consequently been almost universally adopted as standard for motor cars, operating singly or occasionally hauling one or two trailers. The standard straight air-brake equipment consists of the following: Motor compressor, suspension cradle, air compressor governor, motorman's valves with removable handles, brake cylinder, reservoir with hangers and drain cocks, safety valve, gages and exhaust mufflers.

The compressor is very compact and self-contained, and the motor is made strictly in accordance with the standard practice of the General Electric Company in railway motor construction. The four-pole cast-steel magnet frame extends in both directions to form a complete box-shaped covering for the armature and field coils. All bearings are supplied with dustproof doors to provide perfect protection from dust, and at the same time render all parts immediately accessible for inspection. Herring-bone gearing with a removable protecting case is provided, assuring comparatively noiseless operation and long wear. The wearing qualities of the compressor are further assured by straining all entering air through curled hair filters, thus excluding dust and other foreign substances. All parts of the motors and compressors of the same size are interchangeable. Careful provision has been made for the lubrication of all bearings, and the enclosed construction affords complete protection from water and dust. The compressor is supported in a cradle in any convenient place beneath the car. Several sizes of compressors are manufactured to meet any requirement.

To govern the intermittent action of this motor compressor a governor is furnished. This may be located in any convenient place beneath the car or within the car itself, as it is dust, snow and waterproof, and is also of small size. Briefly, this governor consists of a flexible diaphragm and plunger, which operates a pair of contact fingers through a double system of levers. These open and close the circuit in response to the variation in pressure upon the diaphragm. The double series of levers renders the action of the fingers quick-breaking and positive, and a strong magnetic blow-out effectually extinguishes the arc formed on opening the circuit. All parts of this governor, subject to wear, are easily renewable, and the construction, together with the absence of valves of any sort, insures the utmost reliability of action.

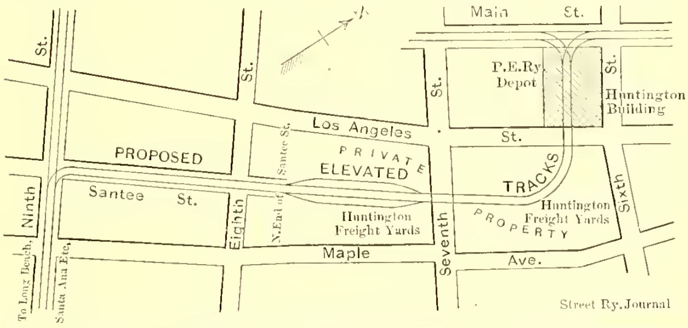
To control the admission of air into the brake cylinder an improved form of motorman's valve is employed. These valves have been specially designed to meet the requirements of the hard service and rough usuage to which they are put. Two forms are manufactured, namely, types S and SS, the latter differing only in construction from the first in that it has an auxiliary valve for admitting air to pneumatic sanders. This is operated by a press button located in the handle, so that the operator can apply the sand during braking or running without removing his hand from the handle. As these valves, from the nature of their service, are subjected to wear, special attention has been paid to the wearing surfaces, which are designed to keep in proper alignment and to facilitate even wear, and also to permit regrinding them when that becomes necessary. These motorman's valves are furnished either of the slide or rotary types. The brake cylinders supplied with these equipments have been designed with a view of incorporating such features as have been found to be most satisfactory in the past, and which, therefore, have become almost universal standards. The cylinders are fitted with tubular piston rods, which surround the push rods to which the brake levers are connected. These push rods are so arranged as to move within the hollow piston rods when the brakes are applied by hand.

The accessory apparatus of this straight air-brake equipment exhibits the same care and attention to detail as the main features above outlined. The reservoirs are made of a special grade of steel. A ½-in. drain cock of substantial construction is furnished with each reservoir; this is fitted with a lever handle. Mufflers are provided to deaden the noise of the exhaust when brakes are released. These do not interfere in any way with the free release of the brakes. In addition to the parts outlined, when two or more motor cars are equipped with the straight air-brake equipment, couplings for reservoir lines between cars are provided, as well as special governors for simultaneous starting and stopping of the car compressors. These retain the same desirable features at the M. C. governor.

The General Electric Company also furnishes automatic equipments and combined straight and automatic air-brake equipments to meet the requirements of all classes of service.

ELEVATED TRACKS FOR LOS ANGELES

The accompanying map shows the route to be traversed by Los Angeles' first elevated railway, which, by reason of the enterprise of Henry E. Huntington, will be built by the Pacific Electric Railway Company to relieve car congestion on Main Street. According to the company's engineers, another important reason for building the elevated tracks is the desire to save all the time possible in the interurban service. All the lands necessary for carrying out the project have been acquired and no time will be lost in putting the plans into effect.



LAYOUT OF PROPOSED ELEVATED TRACKS FOR LOS ANGELES

It is proposed that the new system shall be in operation in little more than a year. The map indicates that the elevated tracks will begin at Ninth Street and run in a northerly direction along Santee Street to a point, and thence westerly into the great Pacific Electric Depot building through its entrance on Los Angeles Street. The installation of such a system will remove from Main Street all the interurban traffic of the Pacific Electric Railway Company to San Pedro, Long Beach, Alamitos Bay, Huntington Beach, Newport Beach, Whittier and Santa Ana.

In the annual report of the Capital Traction Company, of Washington, were given some interesting statistics relative to the character of the accidents to people in which the company's rolling stock figured during the year just past. It appears that 403 persons were injured more or less seriously in the twelve months. Of these, 241 were hurt because of a failure of the passengers or the car crews to observe the rules of caution. Of this number, 139 were hurt while stepping off moving cars, 78 while attempting to board moving cars, 18 through the starting of the car while alighting, and 6 by the starting of the car while boarding. Thus of the 241 persons injured in this general manner during the year, 217 were hurt through their own carelessness, assuming that in every case the passenger was at fault when hurt while trying to board or to leave a moving car.

FINANCIAL INTELLIGENCE

WALL STREET, Feb. 7, 1906.

The Money Market

There has been no appreciable change in the monetary situation during the past week. It is true that the local institutions have lost substantial amounts of cash as a result of their operations with the sub-treasury, and by the shipments of moderate amounts of gold to Argentina, but these losses have not been sufficient to cause any hardening in the rates for either call or time accommodations. On the contrary, money has been in abundant supply throughout the week at comparatively low rates, and there is nothing in the situation at the moment to warrant the belief that materially higher rates will prevail in the near future. The New York City banks continue to gain cash from the interior, and it is expected that the receipts from this source will be sufficient to offset the losses sustained by the local banks to the sub-treasury. Government finances also show considerable improvement. Receipts are in excess of expenditures, and it is probable that the surplus will be restored at an early date. The foreign exchange market has ruled firm, but no shipments of gold to Europe are expected, owing to the fact that money rates at New York are higher than at any of the principal European centers. The Paris market has ruled decidedly easier, the open market discount rate at that center being 2⅜ per cent at the close. At London, the rate was unchanged at 3¾, and at Berlin the quotation was 3¼ per cent. The bank statement, published on last Saturday, was more favorable than had been generally expected. The loss in cash amounted to only $1,129,600, which was considerably below the preliminary estimates. Loans increased $16,251,800, owing to the activity in the stock market. Deposits increased $14,290,500. The reserve requried was $3,572,625 larger than in the previous week, which, together with the decrease in cash of $1,129,600, resulted in a reduction in the surplus by $4,702,235. The surplus reserve now stands at $11,127,625, as compared with $19,841,925 in 1905, $21,842,775 in 1904, $18,645,675 in 1903, $17,896,225 in 1902, $20,362,625 in 1901, and $30,871,275 in 1900. Money on call has loaned at 5 and at 3¾ per cent, the average rate for the week being about 4 per cent. Time money was in better demand, especially for four months, and offerings for all periods up to six months were liberal, at 4½ per cent on ordinary mixed securities. Mercantile paper was more active, and the rate was reduced to 4½ per cent for the best material. Choice single names were discounted at 4¾ per cent, and other good names were marketable at 5¼ to 5¾ per cent.

The Stock Market

The past week in the stock market has been one of considerable irregularity, but with a tendency toward recovery from the previous very sharp decline. Rallies and reactions have followed one another in rather quick succession, and fluctuations in several instances have been over a wide range. However, the volume of speculation has, on the whole, been somewhat smaller than heretofore, and there was a considerable falling off in outside interest, which is not at all surprising, when the late serious slump is taken into consideration. General conditions were every bit as favorable as at any time in the recent past, the only retrograde movement noticed having been a moderate decline in the price of copper metal from the high figures that have been ruling for a considerable time past. Money was abundant and cheap, railroad earnings reports received were of a highly gratifying nature, the bank clearings of the country reached a higher altitude than ever before, and additional evidence was afforded of the practically unprecedented prosperity in the iron and steel trade.

While the favorable factors noted undoubtedly served as a backlog to the market, they failed to impart to the general share speculation that bullish enthusiasm which had come to be such a characteristic of the market. This, no doubt, is accounted for in considerable measure by the tactics pursued by a certain element of professional traders, notably those with Western connections, whose antics in the market of late have been anything but of a character to inspire confidence. Another reason for the lack of bullish enthusiasm has been the widespread talk of the possible strike in both the anthracite and bituminous coal trades during the coming spring, while the further decline in the reserves of the local banks has not been without its effect. Withal, however, the week has witnessed the making of some new high records in the stock market, the most striking cases in point being among the shares of the so-called Hill group. Rumors of deals, "melons," etc., have been current in connection with these properties, and while there has been nothing apparently to base these on, their influence has been none the less accute. Apart from these stocks, there are very few that merit special consideration, as the fluctuations in general, as before stated, were very irregular and had nothing in particular to explain them. It is somewhat remarkable in view of the decline in copper metal referred to that the shares of the copper companies were among the strongest dealt in. However, this is accounted for by the fact that there has been a lot of talk of a settlement of the long-existing differences between the Amalgamated Copper and Heinze interests, which appeared to have a good deal of foundation, though the principals declined to confirm the various rumors current. As for the future of the market there does not appear to be anything in sight to warrant the expectation that conditions will materially change from those now existing; on the contrary, the indications are that, for the time being at least, speculation will remain comparatively narrow, with fluctuations in prices of an uncertain character. Ultimately values will unquestionably rule higher than they are at present, as the country as a whole is rich and fast growing richer, and the money thus being piled up must eventually find an outlet in the market for good legitimate securities.

The feature of the week in the local traction share market has been the opposition that developed to the Interborough-Metropolitan merger. This threatened to hold up the carrying out of this deal, and in consequence the stocks of all the companies concerned declined sharply. The stock of the Brooklyn Rapid Transit Company was also heavy, chiefly because of the attacks that are being made upon that property by a certain city official, and like the balance of the group showed little or no rallying power from the low prices which the selling movement in it occasioned. In the meantime all these companies are going ahead accumulating record-breaking earnings and making additions and improvements to their respective properties, all of which is bound to tell in the long run.

Philadelphia

Moderate activity developed in the local traction issues during the past week, and prices held remarkably well considering the weakness prevailing in the general securities markets. Early in the week some pressure was brought to bear upon the speculative issues, but in the subsequent dealings there were substantial advances. Philadelphia Rapid Transit was again the active feature of the group, upwards of 10,000 shares being dealt in. Opening at 33 it ran off to 32⅛, but later the price advanced to 33¼ on buying for New York account. The close was at 32⅝. Philadelphia Company, after selling at 51½ at the opening, rose to 52⅞ on active purchases, and closed within ⅛ of the highest. About 9000 shares changed hands. Philadelphia Traction eased off a small fraction, about 300 shares selling at 101¼ to 101. Union Traction sold to the extent of about 600 shares at 63¾ and 63½, and several hundred shares of Consolidated Traction of New Jersey brought 82½ and 82. Other sales included Philadelphia Company preferred at 51 to 50½, Railway Company General at 7⅛ to 7, United Companies of New Jersey at 269¼, American Railways at 53.

Baltimore

The market for tractions at Baltimore was fairly active and strong. United Railway issues were the feature, the 4 per cent bonds advancing to 94½, the highest price attained for many months. The free incomes rose from 71⅛ to 72⅜, and closed at 71⅛, about $165,000 changing hands, while the pooled incomes advanced a point to 71¼, on the purchase of about $75,000 of bonds. The free stock sold to the extent of about 3000 shares, at prices ranging from 17 to 17⅜, while the certificates of deposit for upwards of 3500 shares brought 18¼ to 18⅞, the final transaction being made at 18¼. Another noteworthy feature of the dealings was the activity and strength in Norfolk Railway & Light 5s, $84,000 of which changed hands, at prices ranging from 98 to 100½. Other transactions included City & Suburban 5s at 112½, Lexington Street Railway 5s at 104 and 104½, Charleston Consolidated Electric 5s at 97 and 97¼, Virginia Railway & Development 5s at 99, Atlanta Street Railway 5s at 105⅝, and Norfolk Street Railway 5s at 110¼.

Other Traction Securities

Trading in street railway issues at Chicago was extremely quiet, and prices generally displayed a declining tendency. Chicago Union

Traction common was an exception to the rule, the price advancing to 12½, on comparatively light trading, in sympathy with the sharp advances in both the common and preferred stocks on the New York stock exchange. North Chicago Street Railway sold at 75 and 73 for 15 shares, and a small amount of West Chicago brought 45. Other sales included Metropolitan Elevated common at 27¼ and 27, preferred at 70¼ and 69½; Chicago & Oak Park common at 7 and 8⅞, preferred at 27 and 25; Northwestern Elevated preferred at 27 and 26½, and South Side Elevated at 95½ and 95. The Boston market was generally quiet but firm. Boston Elevated rose from 159 to 160 on light transactions, but subsequently declined to 156, ex the dividend. Boston & Worcester advanced from 30 to 32, and closed at 31½, while the preferred moved up from 77½ to 81¾. About 1200 shares of the common and about 1400 shares of the preferred were dealt in. Massachusetts Electric common and preferred continued strong, the first named advancing from 18 to 18¾, while the preferred rose from 67½ to 69, and ended the week at 68½. Other sales included West End common at 99¾ and 99 and 99½, the preferred at 114⅛ and 114, and the 4s of 1916 at 102⅜. In the New York curb market Interborough Rapid Transit was quiet but firm, about 4500 shares changing hands at from 232 to 235, and back to 234. The new securities of the Interborough-Metropolitan Company developed considerable activity, but the price movements were very erratic. The common advanced from 52⅝ to 55½, on the purchase of nearly 20,000 shares, while the preferred stock, after selling at 97, dropped back to 95½. The 4½ per cent bonds were extremely active. From 93¾ at the opening the price rose to 94⅝, but at the close there was a reaction to 93¼. Upwards of $700,000 were traded in. Other sales included 100 New Orleans Railway at 37½, 1250 preferred at 84⅛ and 84; $175,000 New York, Westchester & Boston certificates at 92¼ and 91⅝, 2000 American Light & Traction common at 115 and 121 and 700 preferred at from 99 to 103.

Cleveland Electric declined from 82 to 81¼ and then to 81. Northern Ohio Traction & Light sold at 32⅝ and 33. Several blocks of the 4s sold at 74½ and the 5s at 101. Lake Shore Electric common sold at 16¾ and 17, and Cleveland & Southwestern common at 14¼ and Aurora, Elgin & Chicago at 35. Western Ohio receipts again sold at 18 and the 5s at 87.

Cleveland Electric has been showing some weakness in Cleveland, the price declining from 82 to 81¼ and then to 81, this week's sales aggregating about 600 shares. It is stated that brokerage houses have heavy buying orders if it touches 80. Northern Ohio Traction & Light sold at 32⅝ and 33 for about 500 shares. Several blocks of the 4s sold at 74½ and the 5s at 101, both new high marks. Lake Shore Electric common sold at 16¾ and 17, and Cleveland & Southwestern common at 14¼. Aurora, Elgin & Chicago had a strong movement early this week at 35. Western Ohio receipts sold at 18 and the 5s at 87, both old prices.

Security Quotations

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

	Jan. 31	Feb. 7
American Railways	53	*53
Boston Elevated	159	*156
Brooklyn Rapid Transit	88⅛	86
Chicago City	199	199
Chicago Union Traction (common)	11	11¾
Chicago Union Traction (preferred)	—	—
Cleveland Electric	82	82
Consolidated Traction of New Jersey	81	81
Consolidated Traction of New Jersey 5s	—	—
Detroit United	100⅞	101
Interborough Rapid Transit	232	233
Interborough-Metropolitan Co. (common), W. I	53	55⅛
Interborough-Metropolitan Co. (preferred), W. I	95	95½
Interborough-Metropolitan Co. 4½s, W. I	93½	93
International Traction (common)	—	36½
International Traction (preferred), 4s	—	73
Manhattan Railway	159¾	160½
Massachusetts Electric Cos. (common)	18	18½
Massachusetts Electric Cos. (preferred)	68¼	68
Metropolitan Elevated, Chicago (common)	27	27½
Metropolitan Elevated, Chicago (preferred)	69½	69¾
Metropolitan Street	122½	121¾
Metropolitan Securities	72¼	71½
New Orleans Railways (common)	39	37
New Orleans Railways (preferred)	84	83
New Orleans Railways, 4½s	90½	91¼
North American	102¼	101¾
North Jersey Street Railway	25	25
Philadelphia Company (common)	54	54
Philadelphia Rapid Transit	33	32¾
Philadelphia Traction	101	101
Public Service Corporation 5 per cent notes	95	95
Public Service Corporation certificates	70	69
South Side Elevated (Chicago)	96	96
Third Avenue	136	136
Twin City, Minneapolis (common)	118⅝	116⅛
Union Traction (Philadelphia)	63	63¼
West End (common)	99	99
West End (preferred)	113½	113½

* Ex-dividend. W. I., when issued.

Iron and Steel

Consumption continues at an enormous rate, and shipments of finished iron and steel are close to the record—an extraordinary fact in midwinter. The pig iron markets show some easing off all around for forward delivery. The uncertainties in the labor situation in the coal mining industry are causing some consumers to start stocking up pig iron and coke. The rail makers have thus far taken orders for delivery during 1906 for between 2,400,000 and 2,500,000 tons, exclusive of export sales, with a further constant flow of work.

CONTROL OF ROCHESTER COMPANY TRANSFERRED

Formal control of the Rochester Railway & Light Company and the Rochester Railway Company passed Thursday, Feb. 1, from the hands of the Clark syndicate to the Vanderbilt-Andrews syndicate. First was the reorganization of the Railway & Light Company. These directors were chosen: Horace E. Andrews, William K. Vanderbilt, Jr., Granger A. Hollister, William M. Eaton, W. J. Wilgus, John Carstensen, W. C. Brown, E. V. W. Rossiter, H. D. Walbridge, Edward Bausch, Thomas W. Finucane, Albert H. Harris, A. M. Lindsay, Eugene Satterlee and Henry A. Strong. The directors chose these new officers of the company: Horace E. Andrews, president; William K. Vanderbilt, Jr., Granger A. Hollister and William M. Eaton, vice-presidents; Horace E. Andrews, William K. Vanderbilt, Jr., H. D. Walbridge, E. V. W. Rossiter and John Carstensen, executive committee. These directors were elected for the Rochester Railway Company: Horace E. Andrews, William K. Vanderbilt, Jr., John J. Stanley, E. V. W. Rossiter, John Carstensen, W. J. Wilgus, W. C. Brown, A. G. Hodenpyl, Charles J. Bissell, George W. Archer, Charles T. Chapin, George F. Roth and William Eaton. These directors chose the new officers of the Rochester Railway Company: Horace E. Andrews, president; William K. Vanderbilt, Jr., and John J. Stanley, vice-presidents.

CHANGE IN DATES OF SALE FOR APPLEYARD PROPERTIES

The dates of the sales of the Appleyard properties have been changed, and now are as follows: Feb. 19, for the Dayton, Springfield & Urbana Railway and the Columbus, London & Springfield Railway; Feb. 20, for the Central Market Street Railway and the Columbus, Grove City & Southwestern, and on or about Feb. 24 for the Urbana, Bellefontaine & Northern Railway.

HUNTINGTON AFTER OREGON ROADS

W. D. Larrabee, H. E. French and J. Whyte Evans, of Los Angeles, representing H. E. Huntington, the STREET RAILWAY JOURNAL learns, have been in conference with Andrew Gradon, president, and L. Y. Keady, secretary, of the Oregon Traction Company, for the purpose of closing a deal by which the property and franchises of that company are to pass into possession of Mr. Huntington. This means that the Oregon Traction Company's line projected to Hillsboro and Forest Grove, and already constructed on Twelfth and Pettygrove Streets, is to become the nucleus of a system of interurban railways connecting Portland with various points in the Williamette Valley. The Oregon Traction Company owns franchises in Portland, Hillsboro and Forest Grove, and has bonuses pledged at the two latter towns for construction of a standard gage electric railway, about 26 miles long. Under a contract which the company had with the Atlas Construction Company construction work proceeded several blocks on Twelfth and Pettygrove Streets when the construction company failed, without having paid for its rails, ties and ballast and some labor. Claims against the company amount to $21,000. It is said that these claims will be liquidated by the Huntington syndicate and the property taken over, if franchises now pending in Portland are granted.

UNITED RAILWAYS REPORT

The United Railways Company, of St. Louis, has issued a preliminary report covering the earnings and expenditures of the consolidated St. Louis lines for 1905, and comparing the finances of the company for last year with the showing for 1904, the World's Fair year, and 1903. The report shows that the increase in street car travel between 1903 and 1905, two normal years, was great enough to produce a gain in gross earnings in favor of 1905 of about $1,200,000, as compared with an increase in 1904, an extraordinary year, over 1903 of about $2,700,000. The operating expenses last year exceeded those of 1903, but the gain in receipts was sufficient to offset a deficit in 1903 and leave a surplus of about $500,000 after deducting ordinary fixed charges. This figure gives an earning of 2½ per cent on the common stock, but the company had absorbed this by allowing a deduction of $421,000 as a depreciation and improvement fund, which reduces the final surplus to $104,000. Following are the details of the statement:

	1905	1904	1903
Gross earnings	$8,435,915	$9,953,398	$7,259,460
Operating expenses and taxes	4,896,616	5,751,067	4,513,515
Net earnings	$3,539,299	$4,202,331	$2,745,945
Other income	24,101	24,167	36,387
Total income	$3,563,400	$4,226,498	$2,782,332
Deductions			
Interest on bonds	$2,385,618	$2,365,291	$2,059,800
Dividends on preferred stock	649,160	598,022	587,846
Organization expenses	......	833	1,000
Miscellaneous interest	2,297	80,168	196,473
Depreciation	521,752	......	......
Total deductoins	$3,458,827	$3,044,314	$2,845,119
Surplus	104,573	1,182,184	*62,787

* Deficit.

CHICAGO TRACTION ORDINANCE DISCUSSED

The $75,000,000 Mueller ordinance, passed by the City Council recently, was discussed at a meeting of the City Club, held Jan. 28. Walter L. Fisher offered several criticisms of the ordinance, the most prominent of which were: It provides no working capital to carry the city through the period of construction and preparation—or until operation can be fully attained.

The foreclosure section in the ordinance is not surrounded by the necessary safeguards.

The ordinance does not specify the actual scope of expenditure under the certificate plan.

No rate of fare is provided in case foreclosure proceedings are brought.

In discussing the franchise, Mr. Fisher said: "It is certain that something more than this single ordinance is needed to bring about municipal ownership. There must be either an ordinance based upon the contract plan, or one upon a short franchise grant with the right to take over at an early date, or a construction grant by which a company might operate until the certificate scheme shall have been carried through."

Mayor Dunne does not regard as serious the objections to the ordinance. He said that the ordinance had been gone over carefully by his legal advisers and himself, and they were satisfied with it in its present form. He said further that he had no intention at the present of putting forward his contract plan ordinance, and that he would have no more suggestions to make regarding municipal ownership for the present.

There seems to be no disposition on the part of the local transportation committee or its friends in the Council to revive the franchise ordinance upon which so much time was spent, and which it was hoped at one time would be a solution of the whole controversy.

STATEMENT TO METROPOLITAN STOCKHOLDERS

Because the officers of the Metropolitan Street Railway Company felt that the stockholders were entitled to full information regarding the company, and to the advice of disinterested stockholders, based upon a full investigation of the company's affairs, a committee was appointed, consisting of De Haven & Townsend, Strong, Sturgis & Company and Van Emburgh & Atterbury, who have reported in part as follows, giving the statement of the finances of the company: Under the proposed merger the Metropolitan Securities stockholders receive $93.50 par value of non-assessable common stock of the Interborough-Metropolitan Company in exchange for a share of the Metropolitan Securities stock upon which $75 has been paid, and upon which a further assessment of $25 might be called. The common stock of the new company is entitled to the future profits of the surface, elevated and subway lines of the boroughs of Manhattan and the Bronx, after providing the interest upon the bonds issued in part payment for the Interborough stock and the dividends on the preferred stock issued in part payment for the Metropolitan Street Railway stock. The new common stock will accordingly get the benefit of the enormous growth in the passenger traffic of New York City, whether that growth be upon the elevated and subway lines, or upon the surface lines. The operating officers believe that the operation of the properties together will result in a very large increase in profits beyond what would be possible if the properties were to continue to be operated separately.

They, accordingly, believe that holders of Metropolitan Securities stock greatly improve their position and their chances for an adequate return upon their investment by exchanging their stock for the new stock upon the proposed basis.

The investigating committee published the following statement:

METROPOLITAN SECURITIES COMPANY AND NEW YORK CITY RAILWAY COMPANY

Consolidated statement as of Dec. 31, 1905, of the two companies and their application:

Metropolitan Securities Company received from subscriptions to its capital stock	$15,014,775.00	
Add profit on securities purchased, including appreciation in market values of securities still owned; Third Avenue stock, which was taken over from the Metropolitan Street Railway Company at $125 per share, being figured at $140 per share	2,092,399.46	
Total		17,107,174.46

These resources have been or are to be appropriated as follows:

Operating deficit paid and accrued after deducting income from securities owned	$5,497,585.25	
Estimated amount of special franchise tax since date of lease of Metropolitan Street Railway	2,350,000.00	
Construction, franchises and property, including outstanding capital stock of several corporations owning franchises in Manhattan and Bronx, other investments, engineering and other expenses in connection with proposed subways, organization expenses, etc.	4,530,498.44	
Advanced to leased and controlled companies for construction purposes	1,845,263.03	
Materials and supplies and other working assets	829,215.45	
Balance invested in current assets	2,054,612.29	
Total		$17,107,174.46

The above balance of $2,054,612.29 is arrived at as follows:

Securities owned, appraised at present market values, Third Avenue stock being taken at $140 per share	$13,035,966.00	
Cash, notes and accounts receivable and other current assets	1,108,702.63	
		$14,144,668.63
Less:		
Notes payable	$4,250,000.00	
Interest, rentals and taxes accrued, but not due, and estimated amount of special franchise tax, since date of lease of Metropolitan Street Railway, and accounts payable	6,467,056.34	
Balance due Metropolitan Street Railway Company on account of $23,000,000 payable under lease	1,373,000.00	
		12,090,056.34
Net current assets as above		$2,054,612.29

RAILWAY BILLS OFFERED IN MASSACHUSETTS LEGISLATURE

Of the considerable number of bills affecting street railways now pending before committees in the Legislature of Massachusetts, the one to allow municipal ownership is of special interest. The bill as now drafted provides that any Massachusetts city or town may, within or without its own limits, construct, acquire, own or operate, or lease to one or more street railway companies for terms not exceeding twenty years, one or more street railways or any part of a railway plant. To control a line outside its own limits a city or town must get the approval of the Railroad Commission. Any motive power allowed to private companies may be used. To build or acquire a street railway a city must secure a two-thirds vote of its City Council in each of two successive years, and a town a two-thirds vote at each of two separate special town meetings not more than thirteen months apart. Whenever a railway is publicly acquired and operated under this act, a manager of street railways is to be created, subject to removal by the Mayor in a city or the Selectmen in a town, this manager's term to be five years, under bond; the manager to turn over the profits of the business and give an accounting once every month. Two or more municipalities are allowed to combine to acquire or build or operate street railways, the name of their joint company to be such as they determine, but to include the words, "Municipal Street Railway." Stock of such municipal companies is made transferable only to other cities or towns in which parts of the line may be located. Proceedings for taking over a street railway company by a city, town or municipal company, are similar to those now prescribed for obtaining locations—by local hearing and order, with appeal to the Railroad Commissioners, with the addition that when a municipality or municipal company files an acceptance of an order for purchase, the street railway company may, within thirty days, require and oblige it to purchase. The Supreme Judicial Court, or any justice thereof, is made the arbiter of disputes between the parties as to terms of sale, etc., through the agency of specially appointed commissioners, with the court itself as the board of final appeal. Cities and towns and municipal railway companies are made subject to the usual laws for construction and operation of street railways, and bonds which they may issue on account of ownership of street railways are not to be included in its debt limit.

Another bill receiving attention is one to compel companies to equip their cars with improved headlights. It provides that all companies doing business in the State shall, within two years from the passage of the bill, equip their cars with apparatus for always directing the light from their headlights on the tracks directly in front of them, and especially upon all curves in such tracks. The apparatus must be approved by the Railroad Commission, and the penalty under the act is $50 per car per month during the time when the equipment is not provided after being required. This bill is put in on petition of E. Eugene Gay, and doubtless grew out of the situation in Wellesley, where residents, as previously stated in the Street Railway Journal, complained before the Railroad Commissioners of the annoyance and danger which they had suffered by reason of the lights on the fronts of cars in their town. The Railroad Commissioners are now at work upon a regulative order for the use of such lights, and do not need more legislation before dealing absolutely with the matter.

On petition of John J. Conway, a bill has been introduced to restrict the number of standing passengers carried on street cars. It applies to such street railway cars only as are constructed so as to admit of passengers standing in the aisle, and then provides that the number of passengers so standing shall not exceed one-half the seating capacity of the car. There is no penalty attached to the bill.

Another bill provides a fine of from $20 to $100 for any street railway company refusing to sell on demand, or refusing to accept for transportation, packages or books of six tickets for 25 cents, each of which tickets shall be good for a 5-cent fare on any route between the hours of 6 and 9 in the morning and 5 and 7 in the evening, any day in the week excepting Saturday.

Lowell M. Maxham is the name appearing on the petition for a bill appropriating $5,000, to be expended by the Railroad Commissioners, for the purpose of experimenting and making tests of any new safety appliances on cars, such as fenders and other like implements that will tend to protect passengers on street cars from injury. The bill also would require the Railroad Commissioners, on petition of ten citizens of the Commonwealth, to make an investigation for the purpose of determining the efficiency of any appliances on street railway cars recommended in such petition.

A special excise tax is proposed for corporations furnishing heat, light, power, etc., to State, county, city or town, of 1 per centum of the gross receipts of Massachusetts business, provided the dividends of the firm or company aggregate 6 per cent per annum, and one-half of 1 per cent additional of the gross receipts from Massachusetts business for every per cent of the total annual dividends paid in excess of 6 per cent. The tax would be paid annually on Nov. 1, one-fourth to the State and three-fourths to the cities and towns in which the firms or companies transact their business. The tax is to be in addition to all taxes now imposed, and municipal corporations are exempted.

It is worth noting that the bills advocated by the special recess committee on railway and railroad laws, now pending, establishes new class in transportation lines in Massachusetts, to be known as "electric railroads," distinct from railroads and street railways. "Railroads," in Massachusetts law, are understood to be lines running entirely on private right of way. "Street railways" run primarily in the streets or highways and only incidentally on private right of way (for the purpose of avoiding dangerous grades and curves). But "electric railroads" are designated as a class of lines running primarily on private right of way and only incidentally in the streets and highways.

THE TRAFFIC PROBLEM IN CLEVELAND

Reference was made in the last issue of the Street Railway Journal to plans instituted by the Cleveland Electric Railway Company for diverting many of its cars away from the Public Square, by means of loops in the down-town district. Since the first changes the company has altered several other routes, and the scheme is now working a great benefit to the street car service of the city. There are some complaints from the merchants of the Public Square, but the public, as a whole, seems satisfied, since it is possible for the company to increase the number of its cars and reduce schedules from the center of the city, thus accomplishing two much desired results. It was stated in the original plan for changing routes that the interurban cars would be diverted away from the waiting room in the Public Square, but this was not carried out, so that under the present arrangement the interurbans are not effected.

OFFICIAL INTERFERENCE AT MONTGOMERY

Following the recent purchase of the Montgomery Street Railway, of Montgomery, Ala., by the Montgomery Traction Company, plans were made for operating the properties jointly so as to effect economies impossible when the systems were operated separately. Among the plans evolved was one for the unification of the street car lines, with a readjustment of routes that would better serve the public interest. To carry out this work the company had to secure permission from the Council to make certain connections between the tracks of the systems and to abandon several short stretches of line. Opposition was encountered from the city authorities, who took advantage of the application to demand a readjustment of the terms of the franchises under which the separate companies now operate. In return for the privileges sought by the combined interests, the Council wanted 5-cent fares and 3⅛ cents for teachers and school children, transfers to any part of the city, removal of tracks on certain streets, or payment to the Council of $5,000 to be allowed to leave them there, right to order up third track on Dexter Avenue when it pleased, payment of 1 per cent on gross receipts for a term of years and 2 per cent thereafter. The company refused to consider the $5,000 payment and the income tax, and declined to accept a new franchise with these terms as a substitute for the two franchises, under which it has the right to operate without transfers. To get at the will of the people, General Counsel Ray Rushton of the Traction Company is sending out the following request to the residents of the city:

"If you agree with me, that it is to the interest of the city to have all the tracks of the street railways connected into one system, on condition that the companies:

"Give transfers to any place on the lines for a 5-cent fare;

"Sell tickets to school children at 3⅛ cents;

"Abandon the old car house on Bainbridge Street, and erect a new, modern car house, shops, offices and club rooms, for the employees on the extension of Madison Avenue;

"Remove at the will of the Council the tracks from Mobile and Perry Streets;

"Pay such licenses as may be imposed under the city charter, by the City Council, and taxes at the rate imposed by law on all persons, firms and corporations, I will esteem it a great favor if you will sign and return to-day the attached card."

CHICAGO ELEVATED REPORTS

Net earnings of the South Side Elevated Railway, of Chicago, for the year ended Dec. 31, 1905, were equal to 6.06 per cent on the capital stock, as against 5.54 the preceding year. Gross earnings gained 8.7 per cent for 1905, compared with a decrease of 6.2 for the preceding year. The increase in traffic was 8.47 per cent. In every way the road showed marked improvement.

Following are the financial statements submitted at the annual meeting of the stockholders, Friday, Jan. 26:

EARNINGS		
Month ending Dec. 31—	1905	1904
Passenger	$1,647,987	$1,523,421
Other earnings	62,662	49,898
Miscellaneous	2,697	1,509
Totals	$1,713,347	$1,574,829
EXPENSES		
Maintenance of way and structure	$72,175	$64,946
Maintenance of equipment	141,077	129,035
Conducting transportation	437,934	415,478
General expenses	165,519	153,410
Loop rental and expenses	236,255	207,104
Totals	$1,052,962	$969,975
Total operating earnings	1,713,347	1,574,829
Less operating expenses	1,052,962	969,975
Net earnings	$660,385	$604,853
Bond interest	33,750	33,750
Dividends	409,165	409,149
Surplus for year	$217,470	$161,954

GENERAL BALANCE SHEET

ASSETS		
Cost of property	$12,255,943	$12,312,338
Construction and extension	3,989,900	1,313,942
Capital stock in treasury	92,400	92,400
Materials and supplies on hand	137,878	45,084
Due from individuals and companies	15,905	7,978
Due from agents	9,242	5,182
Current assets	23,443	14,500
Cash on hand	154,059	176,085
Cash on hand—con. and ext	949,249	817,578
Totals	$17,628,023	$14,785,091
LIABILITIES		
Capital stock	$10,323,800	$10,323,800
Funded debt	5,610,000	3,110,000
Current liabilities	336,839	161,377
Depreciation	50,000	50,000
Reserve	1,307,384	1,139,914
Totals	$17,628,023	$14,785,091

In his annual report to the shareholders President Leslie Carter noted the improved position of the property. He gave due credit to the White City for a large portion of the increase in traffic, but pointed out there had been a continuance of substantial gains after the open air amusement season closed.

The structure and equipment, he said, had been maintained in the best order, and he gave the details of new construction and maintenance. There was some extra expense on the Union Loop, which was relaid with steel rails. He declared the platforms on the loop should be made long enough to allow two trains to stand at stations and unload and load at the same time, as a means of facilitating transportation.

Concerning the new construction, he said the contracts therefor had almost all been made at prices less than estimates. The third track on the main line would have been ready for operation by the end of 1905 but for labor troubles of the steel erectors, for which trouble the company was in nowise responsible. Eighty-two per cent of the third track, he said, had been erected. The express service could not be established, however, until all the work had been done.

He said 150 new cars had been ordered and were arriving. These operate successfully in trains with the present equipment, and all can be used for either local and express service. Power was greatly added to during the year by the completion and putting on the line an additional storage battery of 1000-kw capacity. The addition to the power house, he said, would provide two new engine-driven units of 2000-kw capacity each. They should be ready for operation in the spring. He expressed appreciation of the work of all the officials from the general manager down.

The stockholders voted to consolidate the Englewood branch, which is building, with the South Side Elevated. The action was a formal one.

Charles H. Wacker and T. J. Lefens, whose terms as directors expired, were re-elected for a four-years' period. Officers were re-elected as follows: Leslie Carter, president; T. J. Lefens, vice-president; Marcellus Hopkins, general manager; M. F. Hardy, secretary and treasurer.

At the annual meeting of the Chicago & Oak Park Elevated Railroad Company the resignation of Charles T. Page as a director, which had been accepted, was filled by the election of Charles H. Randall to fill the vacancy. There were no other changes in the board or officers, the latter being: Clarence Knight, president; Redmond D. Stephens, vice-president; W. V. Griffin, secretary and treasurer.

The financial statement of the company was issued last November for the fiscal period ended June 30, 1905. It showed a deficit for the year of $110,847, but owing to the continued increase in traffic it is presumed the six months just ended have shown marked improvement.

There was issued a balance sheet of the Chicago & Oak Park Elevated Railway Company for the fiscal year ended Dec. 31, 1905. The railway company is the New Jersey holding corporation, controlling the railroad company, which latter is an Illinois corporation, and the operating concern. The balance sheet showed the railroad securities held by the railway company had increased. There is nothing to be shown in the way of surplus by the railway company until the railroad company shall be able to make excess earnings. The railway balance sheet compares as follows:

ASSETS		
Securities—	1905	1904
Stock and income bonds of the Chicago & Oak Park Elevated Railroad Company, at par	$858,900	$852,800
Carried at	7,670,948	7,464,696
Notes receivable	1,488,600	1,384,150
Cash on hand	814	1,815
Expenses	....	8,339
Total	$9,160,362	$8,859,010
LIABILITIES		
Capital stock—		
Preferred	$3,039,000	$2,986,000
Common	5,645,800	5,416,000
Capital stock, scrip—issued and to be issued for stock on which assessment is paid:		
Preferred	14,405	$45,069
Common	12,557	67,492
Notes payable	448,600	344,150
Total	$9,160,362	$8,850,010

Since the last annual report there have been issued, in accordance with the agreement with the securities committee of the Lake Street Elevated Railroad Company, 530 shares of preferred stock and 2295 shares of common stock.

The amount of stock issued and now outstanding is:

	Shares
Preferred stock	30,390
Common stock	56,458
Total	86,848

The company now holds of the securities of the Chicago & Oak Park Elevated Railroad Company:

Income bonds, par value.................................. $858,900
Stock ....91,446,425-1000 shares

CHICAGO ELECTRICAL SHOW

The Electrical Show, which was held in Chicago, Jan. 15 to 27, was such a marked success both in the way of public attendance and interest displayed by electrical men all over the Middle West, that the management announces that arrangements are already under way for another similar exhibition, to be held in Chicago next January. While the exhibition was one which naturally attracted electric light and power men more than the electric railway contingent, a number of electric railway men were to be seen among the out-of-town visitors to the show during the two weeks it was open. The show was run by the Electrical Trades Exposition Company, of Chicago.

NEW YORK, NEW HAVEN & HARTFORD POWER STATION EQUIPMENT

The power station of the New York, New Haven & Hartford Railroad, from which current will be supplied to the single-phase locomotives for the operation of the company's trains into New York, will be located at Cos Cob, Conn. The apparatus to go into this station will consist of three 4500-hp Westinghouse-Parsons turbo-generating outfits, 11,000 volts, 3000 alternations, single and three-phase; two 125-kw exciters, driven by Westinghouse steam engines; one main switchboard with electrically-operated switches for 11,000 volts. It is understood that in the overhead system girder bridges will be used every 300 ft. to support the catenary construction.

General Manager Higgins, of the New York, New Haven & Hartford Company, has stated publicly that the handling of passenger trains on the system between New York and Stamford, by electricity, will be begun by Sept. 1, and has predicted that by 1908 the line will be equipped for operation between New York and New Haven.

ELECTRIC BELT LINE AND TERMINAL FOR STEAM ROADS ENTERING BUFFALO

Henry J. Pierce, president of the International Traction Company, of Buffalo, was in conference a few days ago in New York with the officers of the steam railroads entering Buffalo regarding the plan to build a union station at William and Curtiss Streets, Buffalo. Mr. Pierce says the plan is for the steam railroad companies jointly to build a station on the site mentioned, and for the New York Central to electrify its belt line and establish convenient local passenger stations at different points, to which the International Company will loop its lines so as to handle traffic expeditiously. If the union station is established at William and Curtiss Streets, the International Traction Company undoubtedly will run belt lines to it direct from the Elmwood district, through Elmwood Avenue and Utica Street, via William Street, and back through Broadway, and also belt lines from other parts of the city. Mr. Pierce has said he regrets very much the action of the people which resulted in the refusal to entertain the overtures of the companies to build on the Cary site, in the heart of the city. He predicts that in ten years the center of population of the city will have changed.

Last Saturday articles of incorporation were filed at Albany for the Buffalo Subway Railroad Company. Mentioned as incorporators are: Frank S. McGraw and William B. Cotter, of Buffalo, and members of the firm of Black, Olcott, Gruber & Bonynge, of New York, by whom the papers were filed. Whether or not the new company is in any way connected with the plan for a subway into Buffalo to be built by the steam roads, as previously noted, could not be learned. According to an unofficial source the company will build a street surface railway underground from a point in Carolina Street, southwest of the land of the New York Central & Hudson River Railroad, thence easterly beyond the city line to a point about 2000 ft. beyond the lands of the Terminal Railway, of Buffalo, in the town of Chectowaga, a distance of 6 miles. A branch about a mile in length will run from the main line at William Street and Fillimore Avenue to the intersection of Curtiss and Lovejoy Streets.

NEW YORK RAPID TRANSIT COMMISSION YIELDS TO CONNECTING RAILROAD

Having surrendered to the Pennsylvania and the New York, New Haven & Hartford Railroad Companies on almost every other demand made by the Bureau of Franchises as compensation for a charter to the New York Connecting Railroad, the members of the contract committee of the Rapid Transit Commission of New York, on Thursday, Feb. 1, waived the matter of the amount proposed in the new terms and invited A. J. Cassatt, of the Pennsylvania, and Samuel Rea, president of the Connecting Railroad, to appear before the committee this week to discuss a reduction.

In his amended franchise, Harry P. Nichols, of the Franchise Bureau, inserted clauses requiring the company to pay the city $250,000 within thirty days after the franchise was signed by Mayor McClellan, $50,000 a year for the first ten years, and $100,000 a year for the next fifteen years, after which a new rate of compensation was to be fixed by an appraisement committee.

Under the original franchise the company would pay the city about $10,000 a year during the first period and $20,000 a year during the latter part of the first twenty-five years. Mr. Nichols has insisted that this sum is entirely inadequate.

PENNSYLVANIA RECORDS MADE PUBLIC

The advance sheets have just been issued of the report by Major Isaac B. Brown, secretary of Internal Affairs and Superintendent of the State Bureau of Railways of Pennsylvania, to the State, covering the operation of street railways and railroads with the Commonwealth for the year ending June 30, 1905. The report shows that the total capitalization of the street railway companies reporting to the bureau is $387,112,703, whereas it was only $17,911,680 in the year 1887. The total assets of operating and subsidiary companies for the year covered by the report was $394,869,902 Turning from the figures which denote the total capitalization, and making a study of assets of operating street railways, it is found that the total amount of cost of road and equipment for all these operating roads was $119,283,196. In addition to this substantial assent of operating street railway companies, stocks and bonds of other companies are owned amounting to $27,260,850, to which may be added cash and current assets $13,550,222, and other assets $10,222,358, making the total amount of assets $170,316,626. The gross income of the street railways of this State for the year covered by the report were $37,888,809. The total number of employees of those companies was 23,486; their compensation amounted to $14,126,876. The number of passengers carried was 854,007,798. For the period covered by the report there were 115 operating companies and 120 lessor or subsidiary companies.

ELECTRICITY AND TRAMWAY PROGRESS IN ENGLAND

The annual return of the capital and traffic of tramways and light railways for 1904-5 issued by the British Board of Trade states that: Since the year 1878 the length of lines open for traffic has grown from 269 to 2117 miles, the capital expenditure from £4,207,350 to £52,675,152, the net receipts from £230,956 to £3,351,977, and the number of passengers carried from 146 millions to 2069 millions. Out of a total of 2117 miles of rails 1780 are electrical. Of 320 undertakings, 174 belong to municipalities. This is twelve more than last year. The number belonging to other parties has diminished from 150 to 146.

Local authorities have applied out of tramway profits £209,881 in relief of rates. Last year the amount was £207,087. This year they have applied to repayment of money borrowed for their tramways £572,725 out of revenue.

The mileage open for traffic has doubled since the year 1898, when overhead electrical traction began to come into general use, and the increase in mileage during the past year was almost equal to the total tramway mileage of the year 1879. The number of passengers carried has multiplied two and one-half times since 1898, and nearly fourteen times since 1879, the total now reached representing forty-eight times the entire population of the United Kingdom at the last census. The capital expenditures per mile open has increased by about 58 per cent since the days of horse traction; but, on the other hand, the percentage of net receipts to capital expenditure has increased in rather larger proportion. The percentage of working expenditure to gross receipts from traffic shows under electric traction a marked reduction, as compared with the time when steam traction was at its highest, and a still greater reduction from the horse period. The number of passengers carried per mile of route open is substantially greater than in the days of steam, and enormously greater (having more than doubled) since the horse period of 1879. The number of passengers carried per car-mile remains nearly stationary since the steam period of 1898, but shows a decided increase on the horse period of 1879. The average fare per passenger shows a tendency to diminish, and has dropped almost exactly 3 farthings per fare since 1879.

STREET RAILWAY PATENTS

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

STREET RAILWAY PATENTS ISSUED JAN. 30

811,037. Danger Signal; William C. Creveling, St. Louis, Mo. App. filed Dec. 8, 1904. An alarm to prevent passengers from passing behind a car and in front of an approaching car on the other track. Also provides a rear illuminated danger signal operable when the trolley wheel is displaced from the wire to warn a car approaching from behind. These signals are operated by storage batteries.

811,101. Electric Surface and Elevated Trolley Railway; Chas. D. Smith, Fond du Lac, Wis. App. filed March 2, 1903. The third rail has cover plates of inverted V section, which plates are forced open by wedge-shaped fingers projecting from the frame at the front and rear of the trolley wheel.

811,153. Trolley Pole; John E. Lagergren, New York, N. Y. App. filed May 25, 1905. The trolley is journaled on a supplemental arm or lever whose relative movement when the pole leaves the wire is effective to apply a brake or lock, which prevents upward movement of the pole.

811,160. Railway Switch; Charles A. Mann, Albany, N. Y. App. filed May 16, 1905. A pair of rods eccentrically pivoted at one end to a concentrically-pivoted horizontal disc, and having their opposite ends freely held in beveled grooves in a block flush with the track surface, and an arm connecting the disc with the switch tongue, and projections carried upon the free ends of the rods adapted to engage depending arms carried on the cars.

811,284. Electric Race Track; Thomas F. Gaynor, New York, N. Y. App. filed March 14, 1905. Details of a pleasure railway, consisting in the special construction and combination of the electric power system of distribution from the generator to the truck motors.

811,319. Railway Switch; William P. O'Brien, Salem, Mass. App. filed July 24, 1905. A pivoted switch arm, an intermittently movable cam-grooved disc in engagement therewith for moving it back and forth on its pivot, means for moving the disc, and an operating device on the car adapted to engage an actuating lever.

811,340. Attachment for Electric Controllers; Ferdinand Volk, Pittsburg, Pa. App. filed Sept. 12, 1905. Details compelling step-by-step movement of the controller handle in turning on the power, but can be moved freely to the off position.

811,415. Regulation of Electric Motors; Johan G. V. Lang, London, England. App. filed June 28, 1904. By the ordinary regenerative system of control the motors are connected in different circuits for the purpose of giging a generative or braking action suitable to the particular speed condition of the train. In order to avoid depending on the motorman to properly move his controller for this purpose the patentee provides an automatic device.

811,519. Electric Switch for Street Railways; James A. Posey, Midlothian, Tex. App. filed March 14, 1905. A shoe adjacent to the track rails is depressed by the approach of a car. The direction in which the switch point moves is determined by a pair of selector magnets operated by a special trolley circuit and under the control of the motorman.

PERSONAL MENTION

MR. THOMAS M. MOORE, of the legal department of the Public Service Corporation, is dead.

MR. GEORGE H. BOWERS, formerly secretary and treasurer of the Peckham Manufacturing Company, of Kingston, N. Y., has become associated with the Audit Company, of New York City.

MR. JOHN JOHNSTONE has resigned as general superintendent of the Muskogee Electric Traction Company, of Muskogee, I. T., and has accepted a position with the Pioneer Telephone & Telegraph Company, of Oklahoma City, Okla.

MR. MARSHALL MORGAN, a son of Mr. Randall Morgan, the Philadelphia traction magnate, has become clerk in the office of the Cincinnati Traction Company, where he will learn the traction business under the guidance of Mr. W. Kelsey Schoepf.

MR. RALPH E. DEWEESE, for the past five years manager of the Dayton & Northern Traction Company, of Dayton, has resigned on account of ill health. A short time ago Mr. DeWeese resigned as treasurer of the Ohio Interurban Railway Association for the same reason. He has been ill for some time, and although convalescing is still in a very weak condition.

MR. W. A. SHARP, of Tacoma, has resigned as assistant superintendent of the Seattle-Tacoma Interurban Railway to accept the superintendency of the Montana Miners' Electric Railway & Power Company, which is building an electric railway from Libby, Mont., for a distance of 25 miles, into the Coeur d'Alene mining district. It will be used solely for freight traffic, the ores of the mines providing the bulk of the shipments.

MR. JACOB P. DUNN, formerly City Controller of Indianapolis, Ind., has been made auditor of the Winona enterprises, consisting of educational institutions, transportation companies and public service corporations, having an aggregate value of $3,500,000. This is a new office, and in addition to looking after the accounts of the Winona Assembly the auditor will also keep the accounts of the Winona & Warsaw Railway Company, the Winona Electric Light & Water Company and the Winona Interurban Company.

MR. ARTHUR B. METCALF, general superintendent of the Fifty-Second Street surface car shops of the Brooklyn Rapid Transit Company, has accepted a position with the mechanical department of the Rochester, Syracuse & Eastern Railroad, with headquarters at Newark, N. Y. Mr. Metcalf was connected with the Brooklyn company for some twelve years. Upon his leaving Brooklyn he was presented with a loving cup by his associates in the company as a token of esteem.

MR. LOUIS J. MAGEE, who introduced American electric railway apparatus in Germany, and who is a director of the Allgemeine Elektricitäts Gesellschaft of Berlin, has contributed an interesting article to the current issue of "The Engineering Magazine," on "The American and the German 'Peril'." Mr. Magee analyzes the industrial conditions of the two countries, and believes that American manufacturers can derive considerable benefit from a study of German methods, particularly in the organization and training of the producing force. He also adds some valuable hints on export trade. The article has been reprinted in pamphlet form.

MR. H. C. MACKAY, for the past nine years comptroller and auditor of the Milwaukee Electric Railway & Light Company, has accepted the position of comptroller of the Virginia & Carolina Coast Railroad Company, with offices at Norfolk, Va. Mr. Mackay's railroad experience dates from Jan. 11, 1886, at which time he entered the service of the Minneapolis, Lyndale & Minnetonka Railway Company. This company was later on absorbed by the Minneapolis Street Railway Company, which retained Mr. Mackay in its employ successively as clerk, paymaster, bookkeeper, chief clerk and assistant auditor. In 1897 Mr. Mackay accepted the position of comptroller and auditor of the Milwaukee Electric Railway & Light Company. Upon his departure from Milwaukee Mr. Mackay was presented with a testimonial by Mr. John I. Beggs, the president and general manager, in the shape of a framed group of photographs of the president, superintendent and others with whom he was intimately associated. Included in the testimonial is a picture of the new terminal station and general office building, together with the following inscription: "Presented to H. C. Mackey, by his associates in the Milwaukee Electric Railway & Light Company, as a token of their sincere friendship and esteem, Feb. 1, 1906."

MR. R. W. DAY, who for a number of years has been claim agent of the Wilkesbarre & Wyoming Valley Traction Company, has resigned from the company to become general manager of the Northern Electric Street Railway Company, now constructing an electric railway from Scranton to Factoryville, passing through Chinchilla, Clark Summit, Clark's Green, Waverly, Glenburn, Dalton and La Plume, with extensions eventually to Tunhannock and Lake Winola, a distant of about 28 miles. From 1890 to 1896 Mr. Day was adjuster in the liability department of the Traveler's Insurance Company, and since 1896 has been manager of the claim department of the Wilkesbarre & Wyoming Valley Traction Company. Mr. Day is a member of the American Association of Street Railway Claim Agents.

R. W. DAY

MR. FRANK CAUM, who has retired as acting manager of the Hartford lines of the Consolidated Railway Company, operating the electric railway properties in New England controlled by the New York, New Haven & Hartford Railroad, to become general manager of the Scranton Railway, of Scranton, Pa., was tendered a complimentary dinner a few days ago by a number of old and intimate friends. Speeches were made touching upon incidents in connection with the management of the Hartford Street Railway, and regrets were expressed at Mr. Caum's leaving Hartford. Among those present at the dinner were Mr. E. S. Goodrich, Mr. J. L. Adams, of the Hartford, Rockville & Manchester Tramways; Mr. H. S. Newton, of the Hartford & Springfield Street Railway; Mr. Charles E. Hubbard, of the Farmington Street Railway, and Mr. Norman McD. Crawford, of the Consolidated Railway Company, with whom Mr. Caum was long associated in the management of the Hartford property. Later in the day a smoker was given in Mr. Caum's honor at the Weathersfield Avenue car house, where the employees' association has its headquarters. Mr. Warren P. Bristol, superintendent of the Meriden lines of the Consolidated Railway Company, who is to succeed Mr. Caum at Hartford, has received from his Meriden associates a gold watch and chain as a token of their esteem.

Street Railway Journal

Vol. XXVII. NEW YORK, SATURDAY, FEBRUARY 17, 1906. No. 7.

Published Every Saturday by the

McGraw Publishing Company

Main Office:

NEW YORK, Engineering Building, 114 Liberty Street.

Branch Offices:

Chicago: Monadnock Block.

Philadelphia: Real Estate Trust Building.

Cleveland: Cuyahoga Building.

London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York"; "Stryjourn, London"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada, Mexico and the Canal Zone.

Street Railway Journal (52 issues)..............................$3.00 per annum

Single copies ....10 cents

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August and November) $4.00 per annum

Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy)..........................$6.50 per annum

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues), postage prepaid.................... $6.00

25 shillings. 25 marks. 31 francs.

Single copies..20 cents

Remittances for foreign subscriptions may be made through our European office.

NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the Street Railway Journal.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires.

NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal 8000 *copies are printed. Total circulation for* 1906 *to date,* 57,000 *copies, an average of* 8143 *copies per week.*

The New Haven Electrification

We take pleasure in publishing this week an account of the plans of the New York, New Haven & Hartford Railroad Company for the electrification of its main line between Woodlawn and Stamford. The anticipations of a radical departure from previous heavy traction work, raised through the adoption by the company of the single-phase system, are certainly realized in the plans which are now announced in detail. It certainly seems startling to think of operating a four-track line, now 22 miles long and with a probable future length of 61 miles, without the help of sub-stations or feeders. We are so accustomed to the sub-station with its accompaniment, up to within recently, of an attendant or attendants, and to an elaborate system of high-tension and low-tension feeders, that a railway system hardly seems complete without them. But the plan adopted by the New Haven company is electric railroading reduced to its simplest terms. In its absence of feeders and translating devices between the generator and the car the method constitutes a return to early d. c. practice, and the abolition of the sub-station and the feeder, particularly the former, should mean a large reduction in the number of possible breakdowns. It is true that 11,000 volts have never before been placed upon a trolley wire employed in this country, but 15,000 volts are used on the Seebach-Wettingen line in Switzerland, and even this potential is low compared with that employed to-day on many transmission systems in both the eastern and western parts of this country. With a strong catenary construction there should be no greater difficulties in insulation than in a purely transmission line, carried at the side of the track or over a pole-line private right of way. The use of this voltage on the trolley wire, it is interesting to learn, permits the reduction of the line losses to less than 5 per cent, a figure practically unattainable by any other system.

Closely associated with this question of voltage is that of the supports for the overhead construction. The plan adopted, that of bridges spanning the track every 300 ft., appears somewhat formidable at first sight, but the cost, $26,600 per mile of route, is certainly not excessive. The use of bridges permits a combination in both construction and operation of the trolley lines with the block-signal system, because the bridges not only carry the semaphores, but will also be provided with an auxiliary safeguard against accident in the form of oil switches by which any section can be cut out of circuit. In this way the tower man, who is a trained operator and who would be required in any event, can look out for the condition of the overhead lines, and can have a physical control over the movements of trains as well as the one provided by the signals.

Second only in interest to the subject of power distribution on the New Haven system is that of the electric locomotives to be used. It is not possible yet to secure a complete description of these locomotives, but the information now available is noteworthy. It indicates that the principal departure from recognized standards in their construction is in the motor suspension, and that in other respects the well-known general characteristics of the usual four-motor car equipment are preserved. In other words, while the motors will be gearless, the locomotives, electrically considered, will be simply a double-truck car with quadruple equipment, with the four motors controlled by the auto-transformer tap method on the a. c. section, and by the usual electro-pneumatic two-motor series-parallel method on the d. c. section.

The Problem of First Cost

One of the first things a capitalist desires to know in a preliminary engineering report upon an electric railway is the total investment which will be required. The amount of money to be raised is, of course, a most important factor in the decision to go ahead with or drop a given proposition, but it is a question if undue importance is not in many quarters at the present time attached to the first cost of equipping a modern electric road. The volume of business throughout the country is to-day so great that the demand for equipment in many cases exceeds the available supply, and high prices are the natural result. In times like these there is no doubt that a good many undertakings are indefinitely tabled to await more favorable estimates of first cost. This is particularly true in the building of homes, and in many commercial enterprises a waiting policy is adopted in the anticipation of lower prices at some later period.

In the electric railway field, it is doubtful if it is in the long run wise to neglect opportunities to make money until the cost of labor, material and equipment shall have decreased noticeably. Of course, the prospect of hard times and diminished traffic must always be borne in mind before saddling a proposition with a heavy burden of fixed charges; but if a project figures out a reasonable return upon the investment, upon the basis of a conservative traffic volume, it is certainly a poor plan to hang fire because the total cost of the enterprise represents high prices rather than low ones in their component items. For example, the man who refuses to buy aluminum wire for a transmission line at, say, 35 cents per pound, because he hopes in a year or two to be able to buy it for 25 cents, fails to appreciate broadly the present opportunity if it can be shown that operating economy lies in the 35-cent purchase, high though the price may be.

The cost of a 2000-kw turbo-alternator may seem relatively heavy in itself to one accustomed to purchasing small reciprocating engine-driven units, but if it can be shown that it will pay to install such a machine in a growing street railway system, the first cost ought not to be a stumbling block. To take still another example, we think it is generally considered that the first cost of a large storage battery is a pretty formidable item in the equipment of an electric road, but after all, what difference does the first cost make if substantial economy can be shown by the use of the battery, allowing liberally for fixed charges and operating expenses? It is an American characteristic to replace out-of-date equipment with modern apparatus, even at heavy expense for making the change, and it is well to remember when the cry of high prices goes up that such adjectives as high and low are merely relative terms; that the industry is constantly growing to demand more substantial equipment and more powerful appliances from the coal pile to the car wheel; that the researches upon designs and experimental development of new equipment cost large sums of money; and that the manufacturer has also to meet the higher labor and material cost in turning out his product. If apparatus could remain standard for several years—say a decade—the price might well be beaten down, but in an art undergoing the tremendous development which now characterizes the transportation industry, stationary conditions are not to be expected. With the expiration of patents legal expenses become more and more prominent, for every claim which can be maintained becomes doubly valuable in the fierce competition of the manufacturing industry. The cost of street cars tends constantly upward; the demand for rails is almost insatiable; copper and aluminum can only be had at relatively high prices, and often only upon long deliveries—and yet below all this lies the great fact that we are developing a country of almost boundless possibilities. Let us figure the fixed charges and operating costs rigorously, but let us not balk at the mere sound of prosperity prices.

Lighting Switch Heads

Considerable difference of opinion exists as to the best method of lighting switch heads. With steam trains the only method usually available, of course, is oil, but certain of the important electric railways in the Middle West are employing electric switch lights, and at least one interurban company has received a contract from a parallel steam road to furnish the switch head lamps of the latter company with electric current. Those roads which have adopted electricity for this purpose state that they consider it not only much more economical than oil, but more reliable. The switch lights are arranged in different ways. Sometimes they are connected to the d. c. feeder, and either burn all day or are turned on and off by the proper crews. On other roads they are tapped off of a special feeder, or pilot wire, from the nearest substation, so that all of the switch lights on each section can be thrown in from the sub-station. Two lights are all that are required at each switch or turn-out. This requires the use either of two 300-volt lamps, or two 110-volt lamps can be used in each head and one or two others, to make the group of five or six, in a despatcher's booth if one is located at the switch. The principal objection to the use of electric lamps in switch heads is, of course, the danger of the lamp circuit burning out or being affected by lightning, and the former danger is undoubtedly increased by the vibration to which the lamps in the ordinary switch head are subjected. Nevertheless, practice has shown that the danger of a light going out unobserved is largely theoretical, as the motormen, who know the location of the switches instinctively, report the defect in any circuit, and when electrically-lighted switches are used, an extinguished light means danger. Moreover, when the lamps are supplied from a separate feeder, it is claimed by the advocates of the electrically-lighted switch that the substation attendant can tell pretty accurately from the ammeter on this feeder whether one of the lamp circuits is out. Perhaps the best answer to this objection is that a number of the longest roads which have been using electrically-lighted switches for some time report no trouble of this kind since they have had them in use.

On the other hand, it is claimed by certain experienced interurban railway managers that there is a decided advantage in favor of oil lights, in that they compel the road department to send a man to visit each switch head twice a day. To perform this duty, the roadman has to walk a considerable distance along the track on foot, and this regular inspection is by no means a detriment to the general good. The use of electricity for lighting switch heads is of such recent date that it is difficult to weigh yet the comparative merits of the two plans, and it is an interesting fact that in the case of two adjoining high-speed interurban lines in a Western State, one is very favorably disposed toward electric lighting, while the other, and the later road, has adopted oil lights for its switches.

Results From Gas Engines

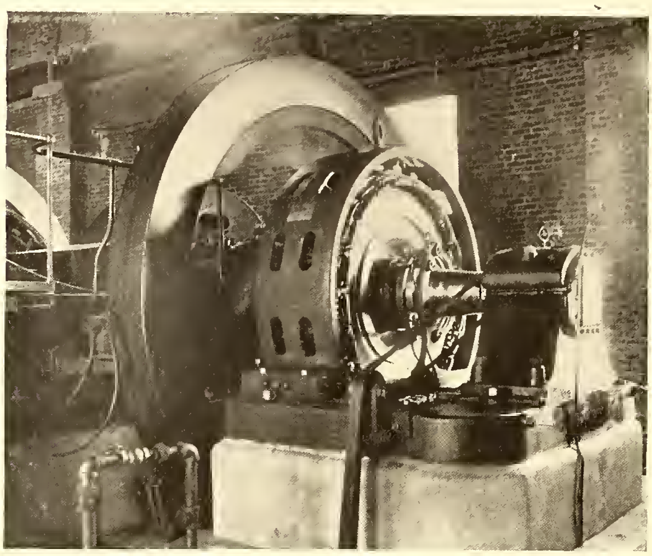
We publish this week a somewhat interesting report of the operation of the Warren & Jamestown Railway, which has the double honor of being one of the small group of single-phase interurbans and of being the only one of the class in which gas engines are used for the station motive power. An interurban road, particularly one like this, operating only three cars, and these at a running speed of nearly 20 miles per hour, is an exceedingly troublesome problem in the way of power supply, and its operation is about the most trying work to which gas engines could be put in a generating station. Hence from an operative standpoint, the success of this plant with its gas engines operating generators in parallel, is very gratifying. In this instance natural gas is the source of power, and is obtained at the low rate of 15 cents per 1000 ft. In many plants in the natural gas belt the gas is used under the boilers, and is found to be a cheaper source of power than coal. Unfortunately, the data given on this Warren & Jamestown road are insufficient to enable one to deduce therefrom the real thermal efficiency of the engines. It is well known, however, that in a well-designed gas engine the thermal efficiency is somewhat more than twice that of a good steam engine, reckoning in each case from the fuel. Hence the use of gas engines is absolutely certain to result in fuel economy, and the question of their use resolves itself into a consideration of their operative properties, reliability, and cost of maintenance. Although the road in question has been in operation now only a few months, the generating plant has been in service about eighteen hours per day and has not developed any serious troubles at all, nor does it show any signs of excessive wear or strain.

The engines in this case are of 500 brake horse-power approximately, each being coupled to a 260-kw generator. The horizontal tandem type chosen gives with the 4-cycle construction two impulses per revolution, so that in this respect the engine acts like a single-cylinder steam engine. The speed, 150 r. p. m., is about what would be expected in a conservatively designed, automatic, single-cylinder steam engine of similar output. It is apparent, therefore, that, so far as the operation of electric generators is concerned, these machines should be very similar to such engines, unless considerable differences should appear in the distribution of internal pressures. As a matter of fact, the indicator cards from the gas engine are quite similar to those from an automatic steam engine, so that from the dynamical standpoint, one is driven to the conclusion that such gas engines should, with good governors, operate as steadily as any other virtually single-cylinder machine. And so in fact they seem to do, the generators being reported as working steadily and well in parallel. The governing device is ingenious. The engines work on a nearly constant mixture, of which the quantity admitted for each stroke is determined by the governor. The work of adjusting the valves for this purpose is not thrown directly on the governor, but is done by an oil relay worked by the governor, so that the work of shifting the supply valves does not make the governor insensitive. This, to our mind, is a very important matter, since gas engines are heavily and strongly built and the valves demand very prompt adjustment to secure good regulation. The Warren station not only handles the interurban service, but seven city cars as well, via a rotary converter. The a. c. cars, as will be noted in the paper, do not run on the d. c. lines, but on their own parallel trolley wires at 550 volts a. c., using on these sections wheel trolleys instead of the pneumatically supported bow trolley employed on the catenary construction of the interurban section. With the whole system working on the gas engine station the cost of fuel per car per hour has been brought down to less than 7½ cents. Unfortunately, no data are at hand for the accurate reduction of this to terms of kilowatt-hours. "On form," however, as our sporting friends would say, the cost reduced to a kilowatt-hour basis should be something under half a cent for fuel.

This implies a very low cost indeed for power under conditions of service that are exceptionally severe. Just how well one would come out in using producer or other cheap gas, it is not easy to figure without more data on the actual performance of the engines under different conditions of load. That one could generally beat out steam very badly on cost of fuel, quite goes without saying, and on the showing made by these engines of the Warren plant the outlook for maintenance and depreciation is promising. Of course, as gas engines are usually rated, their overload capacity is small. As more experience is gained with the manufacture and use of big units, it is exceedingly likely that the moderate load efficiency will be improved and the now rather high costs reduced, so that as commercially rated the engines can make a good showing and still give a considerable overload capacity. There are many small roads now operating very uneconomical steam plants that could save money by using gas engines with producer gas, if they were not deterred by lurking fears of bad regulation and large depreciation. So far as regulation is concerned, the Warren experience seems to be encouraging, and in the matter of repairs and depreciation there is no reason to expect anything very serious if the machinery is well made. The producer itself is generally believed to be the weakest point of the system, and this is the point at which engineers are working. The guarantees of efficiency for producer systems are high—in the vicinity of 1 lb. of coal per ihp-hour even in engines smaller than those here considered. Aside from natural producer and blast-furnace gas, there has been little large work on gas engines. If the gas companies really got out after the business, there is a large field open for them in the matter of auxiliary plants and isolated plants. With a good quality of gas at 50 cents per 1000 ft., or anything under that figure, there is an excellent chance for cheap power production. The economics of the business have not yet been thoroughly worked out, owing to the small number of large units in use. When the big plant of the California Gas & Electric Company gets to running, there will be data of great value available, and we hope they may serve as a guide for important future work. There are plenty of roads suffering for lack of cheaper motive power, which the internal combustion engine ought ere long to be able to furnish.

THE WARREN & JAMESTOWN SINGLE-PHASE RAILWAY

The electric railway, which has recently been opened between Warren, Pa., and Jamestown, N. Y., traverses the valley of the Conewango Creek, through which the waters of Lake Chautauqua empty into the Allegheny River. Warren, the southern terminal of the line and headquarters of the operating company, is located at the junction of the creek and the river, right in the heart of the oil fields and within the natural gas belt, which have contributed so largely to the material development of the western portion of the State. It contains some 15,000 people, while its surrounding territory has a population of 10,000 more within easy reach of the new road. Jamestown, at the other end, is a prosperous manufacturing city of 29,000 inhabitants, and is connected by steam and electric roads with the attractive resorts of the Chautauqua region, whose summer population is estimated at 50,000. The intervening towns, with their surrounding neighborhoods, bring the total permanent population of the territory adjacent to the new railway to upwards of 65,000 inhabitants, or about 3000 per mile of track, exclusive of summer visitors. But the features which make the road particularly interesting are that it is equipped with modern horizontal gas engines as prime sources of driving power, and the single-phase alternating-current system. It is, in fact, the first instance of a single-phase electric railway operated by gas engines. The current is transmitted at a potential of 22,000 volts, fed to the central trolley section at 3300 volts, and to the terminal sections within the city limits at 550 volts, single-phase.



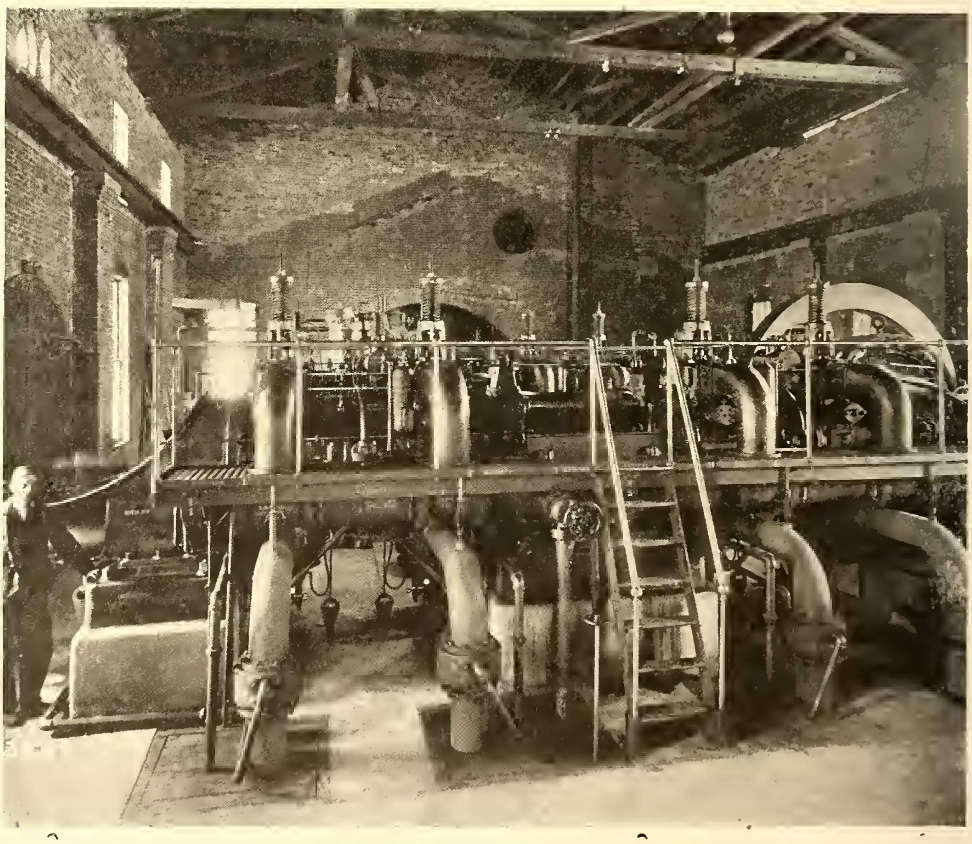
GENERATOR IN WARREN & JAMESTOWN PLANT

TRACK

The track consists of 70-lb. T-rails, laid on ties of oak and chestnut and ballasted with gravel. The rails are connected by the type G, form 2, soldered bonds of the Ohio Brass Company, and are cross-bonded at frequent intervals. As the line follows the winding course of the Conewango it possesses many curves. These, with the grades, one of which is three-quarters of a mile long, with an average of 3½ per cent and a short stretch of 7 per cent, combine to impose upon the power equipment a fluctuating load unusually severe at times. The sharpest curve has a radius of 65 ft. Four turnouts are now in use, but this number will soon be increased to five. The interurban line is 22½ miles in length. In addition, the city lines in Warren consist of about 9 miles of track.

POWER PLANT

The power house is located at Stoneham, 5 miles south of Warren, a site selected by reason of its proximity to the natural gas-pipe lines from which its fuel supply is obtained. The equipment includes two 260-kw, 380-volt, 25-cycle, alternating-current generators of the revolving-field type, which are direct connected to horizontal gas engines operating at a speed of 150 r. p. m. The two units are connected in parallel. The engines were constructed and erected by the Westinghouse Machine Company, and the electrical machinery was furnished and installed by the Westinghouse Electric & Manufacturing Company.



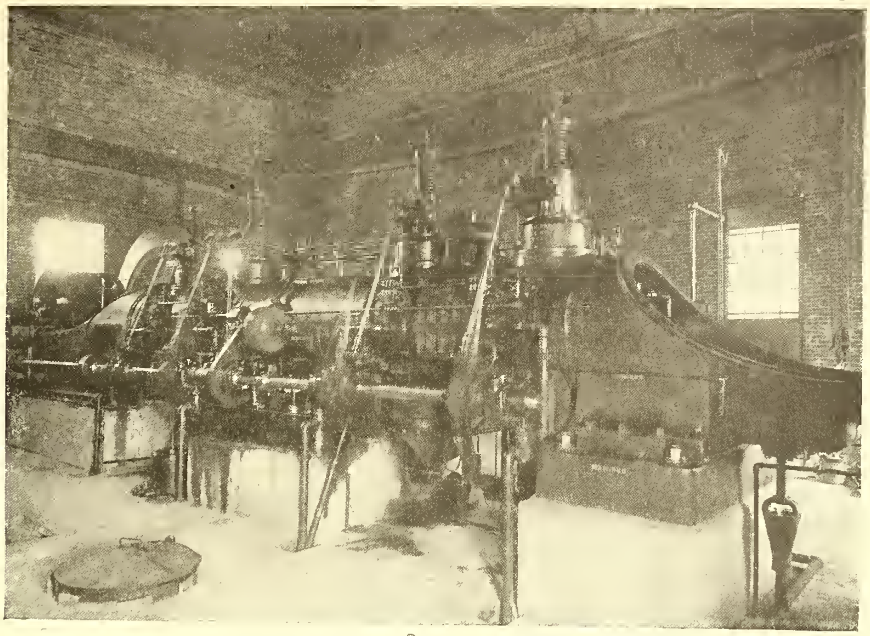
GENERAL VIEW OF PLATFORM SIDE, SHOWING THE EXHAUST ARRANGEMENTS AND DOUBLE-DUCT PIPING TO MAIN VALVES

GAS ENGINE

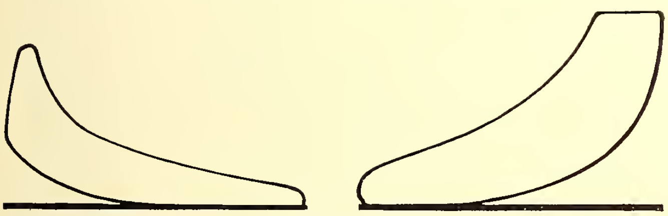
In the new type of horizontal double-acting gas engine, the first representative of which is now operating at Warren, the builders have especially sought to construct a prime mover uncomplicated in design, simple to operate, substantial and permanent in construction, reliable in its working, and possessing the best economy compatible with the more necessary elements of simplicity. The resemblance to approved steam engine practice is strong; in fact, the engine stands not as an example of radical change in structure, but as an adaptation to gas-working of the ample steam experience of the builders in Corliss engines. Symmetrical design has been adopted wherever possible, notably in the cylinder casting with its symmetrical valve chambers and in the pistons.

The absolute necessity of accessible parts has largely influenced the design of the engine and resulted in its elevation to such height that all parts are above the floor level. Inspection and cleaning, especially of cylinders, is possible without dismantling the engine.

Possibility of injury from neglect has been avoided by providing automatic auxiliaries, both oil and cooling water being delivered under the gravity head, cylinder oil by positive pressure and compressed air for starting from storage reservoirs. The starting arrangement has proven particularly efficient, and with only two operations, viz., opening up of gas and air valves, the engine automatically starts and comes up to speed under its own ignition without further attention. On large engines, considerably less than a minute is required to bring the engine up to speed, and, if desirable, a number of engines in a station may be simultaneously started from one point within this period of time. A duplicate system of igniters is employed with four different combinations in each combustion chamber. Any igniters may be replaced while the engine is in service, and in case of necessity any cylinder, or even the entire rear cylinder, may be isolated for repairs during operation.



VIEW OF ENGINE FROM VALVE-GEAR SIDE

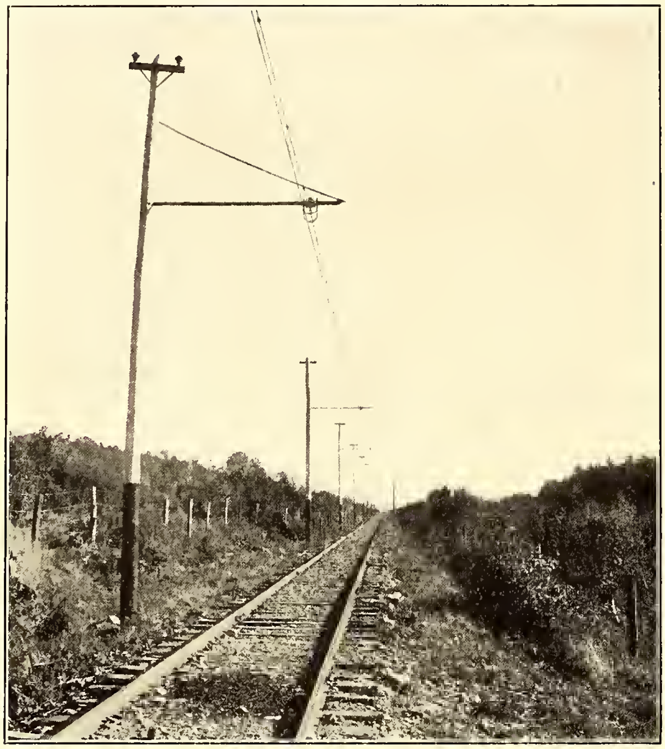


INDICATOR DIAGRAM (REDUCED) TAKEN WITH 160-LB. SPRING, 150 R. P. M., AND THREE-QUARTER LOAD, AND STOP CARD WITH 80-LB. SPRING

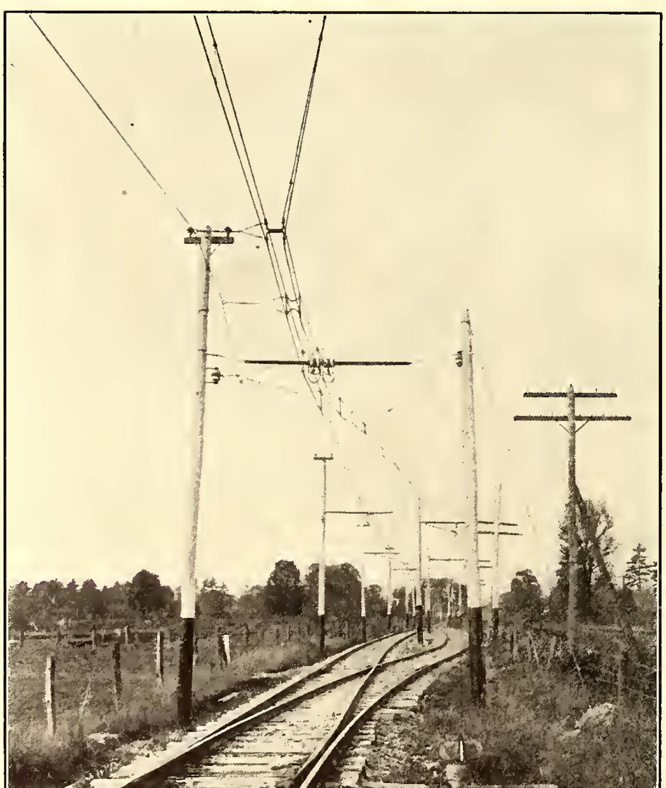
RAISING TRANSFORMERS, FUSE TYPE CIRCUIT BREAKERS, LIGHTNING PROTECTION, ETC., IN POWER HOUSE

There are two main generating units at present installed at Warren, with space for a third of equal size—260-kw, 500-nominal hp. Single-crank tandem units were employed in place of twin-tandem units in order to give greater flexibility of operation, the former representing the standard adopted by the builders. The units have solid couplings between engine and generator, and operate in parallel on the station load in precisely the same manner as an ordinary steam-driven unit. The familiar Beau de Rochas or four-stroke cycle is used, which, with the tandem arrangement, gives a power impulse with each successive stroke of the engine. The cylinders are 21 ins. in diameter by 30-in. stroke. At 150 r. p. m. the engine is rated at 470 bhp., with a maximum of 520 bhp., giving 35 per cent overload capacity to the generator.

A few months prior to the opening of the interurban system a 300-hp vertical type Westinghouse gas engine was installed to drive a rotary converter, the machine first serving the d. c. city road, and later the a. c. interurban road until the main power units could be placed into service. This rotary is now employed to good advantage for supplying the city



TANGENT CONSTRUCTION OF CATENARY

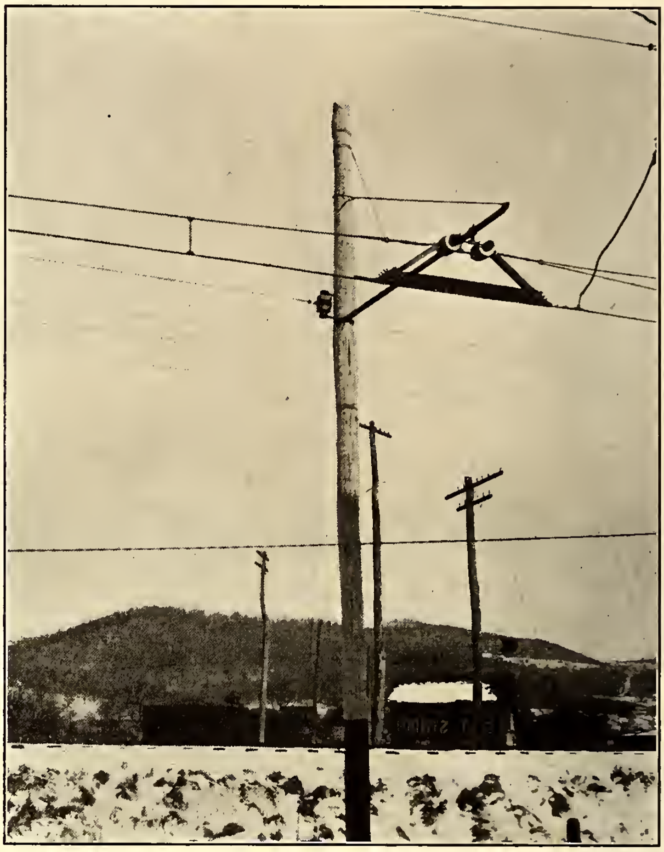


TURN-OUT SHOWING CATENARY OVERHEAD CONSTRUCTION

system from the main alternating-current plant, operating as a simple rotary. In case either side of the a. c. or d. c. plant requires assistance this rotary will be belted to the reserve engine operating either as an a. c. or d. c. generator. A 150 ampere (hour rating) storage battery assists in absorbing the fluctuations of the city load. It floats on the system without a booster, and was first installed for purposes of regulation to assist the old gas-engine plant.

OPERATION

The Warren plant was started on Oct. 19, 1905, and has since been in continuous service, averaging 17½ to 18 hours per day without developing the least trouble of a serious nature. The only prolonged shut-down was made after a two-months' run for the purpose of examining the condition of the interior of the first unit started. Every part was found



SECTION INSULATOR SEPARATING 3300-VOLT AND 550-VOLT SINGLE-PHASE SECTIONS

to be in perfect working order without any evidence of deterioration from wear or excessive strains.

Daily observations of the gas consumption of the plant have been conducted and are presented in the table on page 274. At present the large gas engines operate both interurban and city systems, totaling ten cars. With this combined operation a saving has been realized of approximately 20 per cent in cost of gas over the independent operation of the interurban and urban plants, the former by the new horizontal and the latter by the vertical engines.

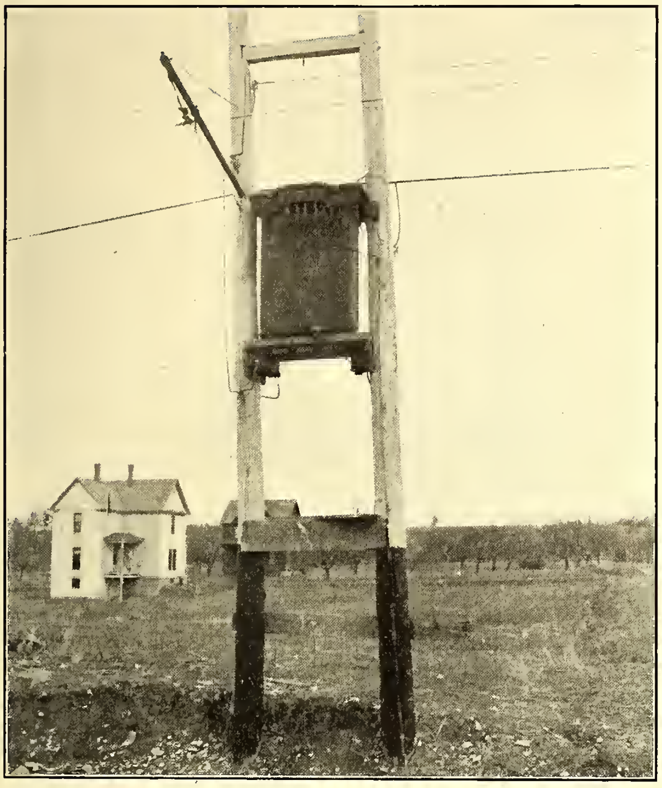
Fuel gas is available from several different points and is clean and uniform in quality, averaging from 1000 to 1100 B. T. U. total per cu. ft. Gas is obtained at a straight rate of 15c. per 1000 cu. ft., which places the cost of power so far below the usual figure that any other source of motive power is out of the question.

TRANSMISSION LINE

The 22,000-volt feeders of No. 6 bare copper wire are carried on Locke No. 406 porcelain insulators, which are supported on chestnut poles. Each feeder connects with a transforming station, one of which is located 1 ¼ miles from the Warren terminal and the other 1 ½ miles from the end of the line in Jamestown.

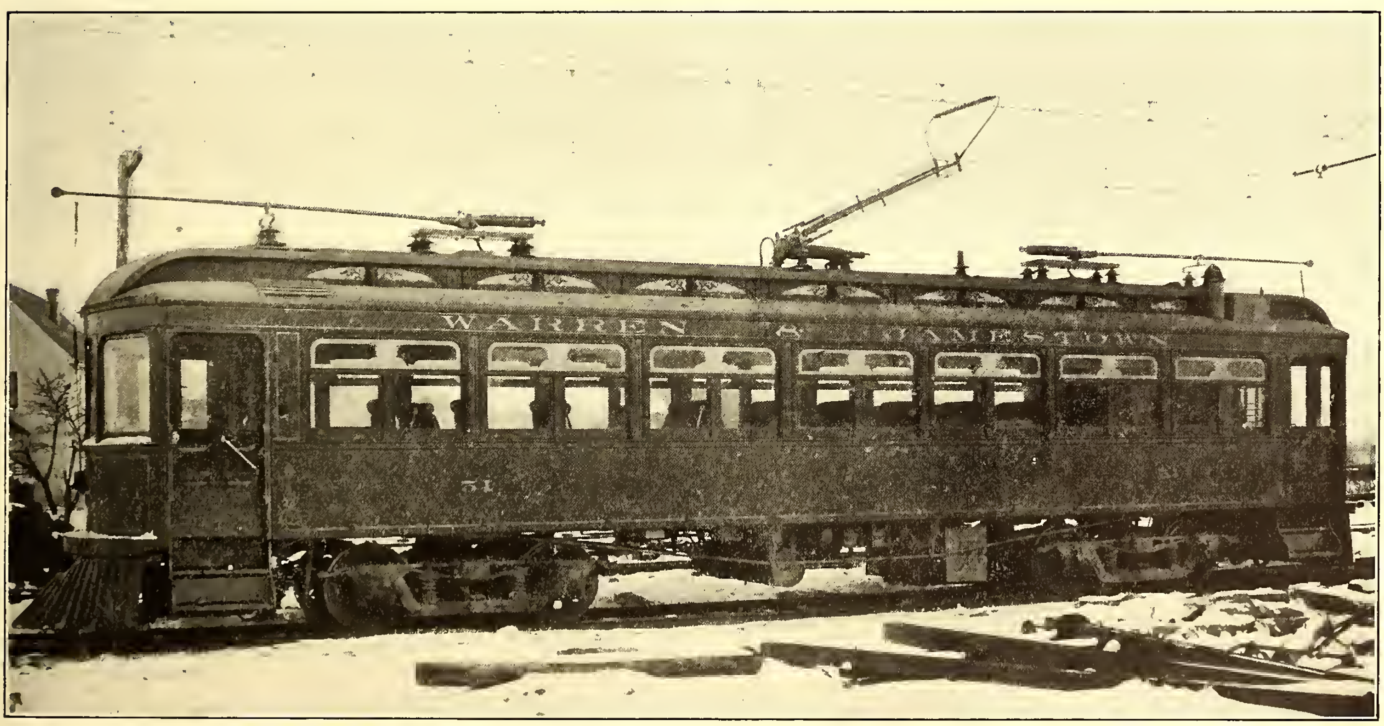
TRANSFORMER STATIONS

The transformer stations are made of concrete blocks, and are of suitable size to permit a wise arrangement of the apparatus. They are similarly equipped, each containing two 150-kw, 22,000-3300-volt, lowering transformers of the oil-immersed, self-cooling type, which are controlled and protected by fuse type circuit breakers and disconnecting switches in the high-potential circuits and by oil switches and enclosed fuses in the secondary lines. One secondary taps the 3300-volt trolley section, while the other feeds the city section of the trolley line through auto-transformers along the track, which reduce the potential from 3300 to 550 volts. Both high and low-potential feeder circuits are protected by choke coils and



AUTO-TRANSFORMER SUPPLYING LOW-POTENTIAL TROLLEY ALTERNATING CURRENT IN JAMESTOWN

OPERATING PLATFORM OF INTERURBAN CAR WITH SINGLE-PHASE CONTROLLER



SIDE VIEW OF INTERURBAN PASSENGER CAR, SHOWING WHEEL TROLLEY FOR LOW TENSION AND BOW TROLLEY FOR HIGH TENSION low-equivalent lightning arresters, which are mounted in the transformer stations. The apparatus is symmetrically arranged, that mounted on one side of the station being exactly duplicated on the other. The two transformers are connected in parallel. Each has sufficient capacity to carry the entire normal load, and either may be readily cut out of service. The transformer stations are operated entirely without attendants and require only occasional inspection. The high-voltage feeder leading to the Jamestown transformer station is carried upon the pole line which supports the overhead construction.

STATISTICS OF OPERATION, WARREN & JAMESTOWN RAILWAY

	Dec., 1905, Interurban Service Only	Jan. 5-12,'06, City and Interurban	Jan. 1-31,'06, City and Interurban
Number of 35-ton cars...........	3	3	3½
Number of 10-ton cars...........	0	7	7
Gas consumed, cubic feet.......	1,701,000	625,000	2,745,000
Gas consumed per day, cu. ft..	54,900	89,285	88 550
Hours operated per day.........	17.5—18	18	18 +
Gas consumption per hour, cu. ft.	3,090	4,960	4 9 0
Cost of fuel per day	$8.24	$13.40	$13.27
Cost of fuel per hour run........	0.464	0.744	0.735
Cost of fuel per car-hour.........	0.155	0.0744	0.7

TROLLEY LINE

As has been indicated, the trolley line is divided into a central and two terminal sections. The central section is connected direct to the transformer stations receiving alternating current at 3300 volts. A No. 000 Fig. 8 trolley wire is swung by catenary suspension from a 7-16-in. messenger cable, which is carried on heavy porcelain insulators mounted on angle-iron brackets supported on the chestnut poles. The poles measure 7 ins. at the top and are 35 ft. long. They are painted white and black and present a very attractive appearance. The white upper portions serve as useful guides to the line of track during the darkness of the night. All poles will be numbered to facilitate the location of line faults and other troubles. A nice detail of the overhead construction is the slight raising of one trolley wire at switch turn-outs, as indicated in one of the illustrations, so that the bow trolley easily passes from one wire to the other without impairment of contact. At frequent intervals the messenger cable is anchored and steady-strain brackets are used at curves and turn-outs. A few of the curves are constructed with pull-outs. The central high-voltage trolley line is separated from the terminal sections by section insulators.

Within the limits of the terminal cities the interurban cars are supplied with alternating-current trolley potential of 550 volts. A feeder from each transformer station leads to three 75-kw auto-transformers, which are located along the track and connected to a No. 0000 secondary feeder which supplies the trolley. The auto-transformers reduce the potential from 3300 to 550 volts. They are swung between pairs of poles, as shown in the illustration on page 273.

The low-potential trolley line is supported from span wires by insulating hangers, in accordance with the practice standard for direct-current work. In Warren, the new cars run over the tracks of the Warren Street Railway Company, which at present is equipped with the direct-current system. The two trolley wires—alternating current and direct current—are suspended side by side from the same spans without appreciably complicating the structure or in any way impairing the service of either system.

CARS

The company owns for its interurban service five passenger cars and one baggage car, all of which were furnished by the St. Louis Car Company. The passenger cars measure 52 ft. over all by 9 ft. in width and are equipped with 33-in. wheels and 5½ in. axles. They seat fifty-nine people and are supplied with baggage racks and a smoking compartment at one end. They are finished in mahogany.

Each car is equipped with four Westinghouse No. 108, 50-hp single-phase motors, which are connected permanently in multiple and are operated by the hand-control system by means of taps from an auto-transformer. The controllers are of the drum type and closely resemble those of direct-current practice, though they occupy somewhat less space.

The bow trolley is used on the 3300-volt section, the wheel trolleys on the terminal sections of the line. A change-over switch is arranged to cut out the bow trolley and transfer the connections of the wheel trolleys from the low to the high-voltage service taps of the auto-transformer, so that, in case of accident to the bow trolley, the wheel trolleys, which are mounted on heavy insulators, may be used on the 3300-volt section of the line. The bow trolley is pneumatically operated, the controlling valve being mounted on the platform within easy reach of the motorman. The wheel trolleys are handled in the ordinary way with ropes in which suitable insulators have been inserted to guard against the possibility of ground when used on a high-voltage circuit.

EXPRESS CAR CARRYING BOTH WHEEL AND BOW TROLLEY

The cars are equipped with Westinghouse straight air brakes, operated by means of an air compressor, which is driven by a single-phase, series-wound motor of a construction similar to that employed for the main driving motors. Hand brakes are also supplied.

The car, complete with equipment but without load, weighs approximately 66,000 pounds.

SERVICE

The winter schedule requires two passenger and one baggage car. Commencing at 6 o'clock in the morning cars leave either end of the line every hour and a half; this service continues until 11.30 p. m. The run of 22½ miles is made in an hour and ten minutes, each car laying over about twenty minutes between trips. There are fifty-three stations along the line at which stops may be made; the average run each way includes about fifteen stops. The maximum running speed is 50 miles per hour. The complete run from terminal to terminal without stops has been made in 47 minutes.

The change from the high to the low-voltage trolley is easily accomplished. As the car approaches the terminal section the motorman releases an air valve, thereby lowering the bow trolley, which automatically closes down and locks in place. After passing the section insulator the conductor places the wheel trolley on the line in the ordinary way. The change-over may be made without stopping.

Under present arrangements the car is run two days with a mileage of 246, and is then brought in for inspection. The bow trolley shoes are found to give a life of approximately 10,000 miles. So far there has been no indication of undue wear of the trolley wire, nor has there been any trouble with the overhead structure. The baggage car makes three trips per day on the regular schedule.

The present service of the Warren & Jamestown Street Railway Company requires a total of but eight employees, outside the general offices and car crews. It is made up of four men in the car houses, three power-house attendants and one line-man. An additional line-man is occasionally borrowed from the Warren Street Railway Company.

ORGANIZATION

The officers of the company are: D. H. Siggins, president; H. M. Preston, vice-president; S. Q. Smith, secretary. Mr. Siggins is assisted in the management of the property by his son, H. A. Siggins, a director of the company and general manager of the Warren Street Railway.

INVESTIGATION OF PUBLIC OWNERSHIP

The Public Ownership Commission of the National Civic Federation, which was organized to examine into the relative merits of municipal and private ownership and the operation of quasi public utilities in this country and abroad, has completed all of its plans and begun the actual work of investigation. As announced in the issue of this paper for Oct. 14, 1905, a committee of twenty-one was appointed to investigate the subject of municipal and private ownership of public utilities, and a list of the committee was published in that issue. On Nov. 27, this committee appointed a sub-committee of five, whose names were printed in the issue of this paper for Dec. 2. This sub-committee consists of Frank J. Goodnow, of Columbia University; E. W. Bemis, superintendent of the Cleveland water works; Walton Clark, third vice-president of the United Gas Improvement Company; M. R. Maltbie, of New York, and J. W. Sullivan, editor of the "Cloth-Trades Bulletin."

This sub-committee has drawn up a list of questions, about a thousand in number, relating to the franchises under which public utility corporations are operating, political conditions in the different cities, the efficiency of the service rendered and the financial results secured. The sub-committee has also selected some twenty or thirty representative cities at home and abroad, whose public utilities will be studied along the lines decided upon. It is proposed to send experts to each of these plants and gather facts pertaining to the investigation. In most cases two experts will be sent to each plant, one representing the so-called municipal ownership view and the other the so-called private ownership view. When these reports are received, they will be examined by the committee of twenty-one, and, if they are incomplete in any particular or if any question arises as to any point in connection with the investigation, the entire committee of twenty-one, or as many as can attend, will visit the place from which the report has been received, examine the facts and settle any disputed questions upon the spot. This plan will be followed in the case of all of the foreign and American cities under investigation.

For convenience in carrying on the investigation, the sub-committee of five has selected Walton Clark and Prof. Bemis to direct the expert investigation which is to be conducted in the cities in this country. It also selected Milo R. Maltbie and William J. Clark, of the General Electric Company's foreign department, to conduct the expert examinations for the foreign cities. Mr. Maltbie sailed for London last week. Owing to pressure of other duties, Mr. Clark was not able to accept this appointment, so that J. W. Sullivan, who is a member of the sub-committee of five, was appointed to take his place and sailed for Europe Feb. 15. The following is a list of the experts who have already been appointed to carry on this investigation. They will be supplemented by two or three British experts, who will be engaged in England by the members of the commission which have the European reports in hand:

Theodore Stebbins, of Columbus, Ohio, and C. E. Phelps, Jr., of Baltimore; engineering of electric lighting plants in the United States;

C. J. R. Humphreys, of New York, and assistant; similar work for gas plants in the United States;

Albert E. Forestall, of New York, and L. L. Merrifield, of Toronto; gas plants in the United States;

Marwick Mitchell & Co., of New York; accounting work in both the United States and Europe;

Robert C. James, of Wallingford, Pa., accounting work abroad;

Alton D. Adams, of Worcester, Mass.; Massachusetts system of regulating electric light plants;

Albert E. Winchester, of South Norwalk, Conn.; engineering of British electric light plants;

Prof. John R. Commons, University of Wisconsin, and J. W. Sullivan, of New York; labor conditions in the public utility plants of the United States;

Prof. Lee S. Roe, University of Pennsylvania, Philadelphia; history of the municipal gas plant in Philadelphia;

Walter L. Fisher, of Chicago; history of the municipal electric lighting plant in Chicago;

Dabney H. Maury, of Peoria, Ill.; engineering features of the water-works plants in the United States;

Prof. John H. Gray, of the Northwestern University, Evanston, Ill.; public documents bearing on the question of municipal ownership of public utilities;

J. B. Klumpt, of Philadelphia; engineering features of the electric lighting and gas plants of Great Britain.

It is also probable that N. McD. Crawford, of Hartford, will report on the subject of the street railways and tramways in Great Britain. The expert to report on the street railways in this country has not yet been appointed.

It is planned, after the experts finish their work and the general committee has visited the plants under investigation, to issue an elaborate report giving the findings of the commission. In view of the extent of the work, this report will probably not be ready until late in the present year. The work has been and is being conducted with a sincere desire to secure the facts in all cases, and it is interesting to note that all decisions made by the sub-committee so far have been by unanimous vote.

ELECTRIFICATION OF THE NEW YORK, NEW HAVEN & HARTFORD RAILROAD

Plans are now completed for the equipment of the main line of the New York, New Haven & Hartford Railroad Company between Woodlawn and Stamford, a distance of 21.45 miles, and tests under service conditions of the first of the single-phase electric locomotives to be used on this line will be conducted at Pittsburg about March 1. A few particulars of the proposed electric equipment of the New Haven system have been published in previous issues of this paper, but the following general summary, it is thought, will be of interest:

POWER STATION

Between Woodlawn and New York the trains of the company will run over the tracks of the New York Central and Hudson River Railroad, and power for train operation will be purchased from the New York Central Company by the New Haven Company. After reaching Woodlawn the trains pass on to the New Haven tracks and will then take current from a new power station which is to be erected by the New Haven Company on the west bank of the Miamus River at Cos Cob. The site selected is just south of the main line of the company and on tide water, which will permit the use of sea water for condensing, and a dock will be built for the reception of tide-water coal. A spur will also be run from the main tracks so that fuel may also be received by rail. The station will be of concrete construction and will be built by Westinghouse, Church, Kerr & Co.

The steam generating equipment will consist of water-tube boilers of 9000 nominal horse-power capacity. The generating equipment will be four Parsons steam turbines, each rated at 3000-kw capacity. The generators will supply single-phase current at 11,000 volts and 25 cycles, but they will be wound so as to deliver three-phase current if desired. The equipment of the station will also include two 125-kw steam-driven exciters and the 12-panel switchboard on the engine-room floor. No step-transformers will be used, as power will be distributed at 11,000 volts. The design of the station is such that it can easily be extended as the requirements for power of the company demand.

The power station will also supply three-phase current for the operation of air compressors for the signal system and for a small amount of power for other purposes along the line.

OVERHEAD CONSTRUCTION

As already announced, the company is planning to operate trains on its own line by overhead wires. These wires will be carried on steel structural bridges which will span four, and in some cases six, tracks. They will be spaced 300 ft. apart, and will be mounted on concrete foundations. The trolley wires will be central over the tracks. Each trolley wire will be suspended from two steel 5/8-in. catenary cables, which will be supported on insulators mounted on the top of the cross trusses, while the trolley wire will run under the cross trusses. Each trolley wire will be supported every 10 ft. from its two steel cables by triangles and will be carried at a uniform height of 22 ft. above the rails. This height will give a clearance of 3½-ft. to a 6-ft. man standing on top of a 12½-ft. freight car. This height, it is thought, will also be sufficient to prevent any deleterious effect from the gases of combustion of the steam locomotives which will haul freight trains or passenger trains until the entire work of electrification is completed. No. 0000 trolley wire will be used.

A block-signal system with sections approximately 2 miles in length, which is considerably less than the length of the present block, will be used, and there will be a tower with a signal man at the end of each section. This tower man will have under his control oil-circuit breakers, which will be placed in each trolley wire between the two adjacent block sections. At these points the catenary cables will be broken and suitably fastened on strain insulators to bridges of heavier construction than those used elsewhere. These bridges at the ends of sections are also designed to serve as signal bridges, and will carry the block signal semaphores as well as the oil-circuit breakers. All the trolley wires will normally be connected in parallel, but any two-mile section of any track may be disconnected by the tower man, if desired, by means of the circuit breakers already mentioned. A relay feeder on each side of the tower bridge, suitably looped in at the section terminals, will provide against interruption to service on more than one section at a time, due to any trouble on that section.

It has been found that with all the No. 0000 trolley wires connected in parallel, no additional feeder will be required for purposes of increasing the conductivity, and that the average losses on the distribution system will be less than 5 per cent. As the current will be collected by the locomotive at 11,000 volts, no step-down transformers will be required except those on the locomotives. For this reason no transformer sub-stations will be required, but suitable lightning protection will be provided at the end of each two-mile section.

ELECTRIC LOCOMOTIVES

At present the company is planning to haul all of its trains by electric locomotives. It is possible that later multiple-unit trains will be used, but it was considered desirable not to complicate the situation by the introduction in the first equipment of multiple-unit trains. Among the other reasons which led to this decision were the use of both a. c. and d. c. between Stamford and New York, the desirability of utilizing the existing rolling stock, and the fact that no stops are made between Mt. Vernon and New York.

The locomotives will weigh approximately 72 tons each and all of the axles will be driving axles. The locomotives consist essentially of a steel frame mounted upon two swivel trucks, each of which is equipped with two Westinghouse 250-hp, single-phase gearless motors. These motors are carried on an ingenious form of suspension by which not only the weight of the field but also that of the armature is supported on springs. The motors are capable of operating either on the single-phase current used on the company's own lines, or on 300-volt direct-current. When the locomotives are on d. c. service between Woodlawn and Forty-Second Street, each pair of motors will be coupled in series and will be operated as a unit.

The locomotive control is electro-pneumatic and includes the transformer for reducing the line e. m. f., an air compressor for supplying air to the brake, controlling apparatus and whistle, suitable blowers for ventilating the motors, a flash boiler for train heating, bow trolley, etc.

Each locomotive unit, as described above, is capable of handling a 250-ton train between New Haven and New York under the most severe local schedule practicable over the road. For heavier trains, two or more locomotives may be connected together, if desired, and operated as a single unit by means of the multiple unit. This division of the locomotives into comparatively small units not only reduces their first cost but keeps down the maintenance cost of both locomotives and of the track, besides affording all necessary flexibility for the handling of heavy trains. Under normal voltage and with the average weight of trains as it now obtains on the New Haven system, the locomotives will be capable of maintaining a maximum speed of 80 miles per hour on a tangent level track.

The step-down transformer used in the locomotive will be provided with a high-voltage loop by which increased speed can be secured when desired for emergencies.

MISCELLANEOUS

All contracts have been let with the plan of completing the electric system from Woodlawn to Stamford so that operation can be commenced by Sept. 1, 1906, and up to the present all work has been carried out ahead of the schedule. No definite decision has been made for extending the electric system on the main line from Stamford to New Haven, but it seems to be the general belief that this will be done not long after the completion of the line to Stamford, as New Haven is the logical terminus of the suburban traffic out of New York. The location of the power house is well adapted to such an extension, which would make the total distance to be electrified, if counting from Woodlawn to New Haven, 61.2 miles; or, if counting from Forty-Second Street, of 73.23 miles. No plans have yet been made for the electrical equipment of the New Rochelle-Port Morris branch, partly because this line is now being reconstructed as a six-track line and partly because it is used mainly for freight.

The Westinghouse Electric & Manufacturing Company will supply the locomotives and overhead construction; the Westinghouse Machine Company, the turbines, and Westinghouse, Church, Kerr & Company have the contract for the power station.

The main items in the cost of electrification from Woodlawn to Stamford will be approximately as follows:

Power house, including real estate (12,000 kw)..	$1,130,000
Overhead construction (21.45 miles)............	570,000
Locomotives (thirty-five)......................	1,050,000
Total	$2,750,000

GOVERNMENT REPORT ON BENEFIT ASSOCIATIONS

The Bureau of Labor of the United States, Department of Commerce and Labor, at Washington, is preparing a report covering the various systems of workingmen's insurance and employers' liability, both in this country and abroad. The report will cover insurance against sickness, accident, disability, old age, death and unemployment.

In this connection it is endeavoring to secure information concerning all street railway associations, and especially to obtain, wherever possible, copies of constitutions, rules and by-laws, blank certificate forms, and any other matter relating to funds of this character.

Charles P. Neill, Commissioner of the Bureau, states that all information of this character would be much appreciated by him, and may be addressed to the department at Washington.

The Hudson Companies, which is to operate an underground electric railway between Jersey City and Thirty-Third Street and Sixth Avenue, New York, has awarded a contract for forty steel cars to the American Car & Foundry Company, and one for ten cars to the Pressed Steel Car Company.

COMPARISON BETWEEN SINGLE-PHASE AND THREE-PHASE EQUIPMENT FOR THE SARNIA TUNNEL

BY C. L. DE MURALT

The question whether continuous currents or alternating currents should be used for electrifying our trunk lines has been quite thoroughly discussed of late. In the issue of the Street Railway Journal for Jan. 20, there is a very interesting article descriptive of the single-phase alternating-current equipment now building for the Sarnia tunnel of the Grand Trunk Railway. It is probably safe to assume that the calculations made for this work must have showed quite a decided advantage for the alternating-current system over the continuous-current system, else the responsibility would hardly have been taken of employing a new system in a case where the well tried and standardized continuous-current system was otherwise well adapted. In general it may be said that the advantages of high pressure alternating currents for all heavy traction problems seems to-day to be well realized, but the difference which exists between single-phase and polyphase alternating currents does not seem to be so well understood, and I fear that some of the best points of the polyphase system are not fully appreciated. It is my purpose in the following lines to show what three-phase alternating currents could have done in the case of the Sarnia tunnel, in order that everybody interested in this question may be able to compare the advantages of the two alternating-current systems and draw his own conclusions.

In order to avoid all possible misunderstandsings, I desire to clearly state at the beginning that it is not my intention to criticise in any way the choice made for the Sarnia tunnel equipment. As a matter of fact, I feel convinced that the equipment ordered will be well able to take care of the situation, and I certainly expect to see it render a good account of itself, so that it may furnish a further proof of the general advantages presented by electricity over steam as motive power for heavy railroading.

What I shall attempt to show is, that the use of a three-phase alternating-current system would have effected a certain, not inconsiderable, saving in first cost of installation, as well as in cost of operation, and that in addition to this the three-phase system would have presented certain unique features which would have increased the security against interruption of service, so important for equipment of this character.

The article describing the Sarnia tunnel equipment is the first one containing sufficient data to form the basis of a comparison between the performance of the single-phase and the three-phase alternating-current system with reference to a concrete case. I have long been waiting for such data, and I shall now make use of this opportunity for comparing the two systems, even though I am free to say that the conditions in this instance are about as unfavorable as they possibly can be for the three-phase system. It is well recognized that the latter is at its best where long runs are made at constant speed, and where the traffic is so distributed that the energy recuperated by trains running down grades can always be usefully employed. Neither of these conditions is fulfilled in the case of the Sarnia tunnel. If I can show, therefore, that even under these unfavorable conditions the three-phase system is superior to the single-phase system, the conclusions ought to carry all the more weight, and I trust that my labor will not have been in vain, but will induce all who have to figure on similar propositions to look carefully into the merits presented by polyphase alternating currents in work of this character.

I shall compare the two systems with reference to the following points: weight and power of locomotives, fulfillment of prescribed speed schedule, energy consumption, maximum power consumption, cost of installation and cost of operation.

BASIS FOR COMPARISON

The conditions prevailing in the Sarnia tunnel are given by the following abstract of the specifications:

A profile of the line to be electrified is shown in Fig. 1. The tunnel proper is 6032 ft. long, 1718 ft. of which extend under the river bed and have a grade of 0.1 per cent eastward for drainage, while the rest of the tunnel is built to a 2 per cent grade, of which 2399 ft. are on the Port Huron side and 1915 ft. on the Sarnia side. Beginning at the Sarnia portal the 2 per cent grade is continued for 3269 ft. to the summit, and from this point the tracks are practically level, extending through the yards to a point 3949 ft. from the summit. From the Port Huron portal the 2 per cent grade continues for a distance of 2515 ft. to the summit, and from this point to the end of the yards, 3583 ft. distant, the track is practically level. While the track through the tunnel proper is single, the approaches to the tunnel are double tracked up to a point about 300 ft. distant from each portal. The total distance from terminal to terminal to be electrically equipped is 19,348 ft.

Both passenger and freight trains arriving from either direction are to be hauled through the tunnel electrically. Owing to the great importance of avoiding all possible chances for a wreck, it was thought best to keep the strain on the draw-bars within 50,000 lbs., which will just enable the locomotive to haul a 1000-ton train up the 2 per cent grade.

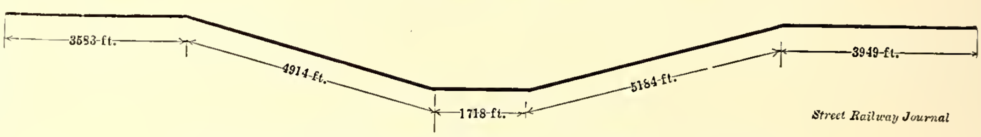


FIG. 1.—PROFILE OF THE SARNIA TUNNEL RAILWAY

Each locomotive must be capable of taking a 1000-ton train through the tunnel block from summit to summit (see profile) in fifteen minutes and continue this service throughout the day of 24 hours, operating under the following conditions: It will be coupled to its train on the level track at a point 1200 ft. from the summit and accelerate this train up to a speed of 12 miles per hour in 2 minutes, when it will have reached the summit of the grade. It will then coast down the 2 per cent grade, and on to the level portion of the track in the tunnel at a speed not exceeding 25 miles per hour. As soon as the train is all on the level track, the locomotive will begin taking current, so that by the time it has reached the foot of the ascending grade it will have taken the slack out of all the draw-bars. From this point to the top of the grade it will haul the train at the rate of 10 miles per hour until the entire train is over the grade and on the level track. It will then gradually accelerate until it has reached a speed not exceeding 18 miles per hour, and at this speed it will run into the terminal. After coming to a stop in the terminal yard it will uncouple and immediately run back to a point 1200 ft. from the summit on this side, where it will couple on to another train and be ready to start through the tunnel in the opposite direction as soon as the next train clears the tunnel block. It will thus make a run of the above character through the tunnel every 30 minutes. The locomotive must also be capable of starting a 1000-ton train from rest upon the 2 per cent grade.

Each locomotive may be built either as one single unit capable of hauling a 1000-ton train as specified above, or it may be composed of two smaller units coupled together, each capable of hauling a 500-ton train under the same conditions. In the latter case each part must be complete and the two parts must be arranged for multiple-unit control from the cab of either part. Each complete locomotive capable of hauling a 1000-ton train under the conditions above mentioned shall weigh not less than 100 tons nor more than 140 tons of 2000 lbs., all of which shall be carried on the driving wheels. Preference will be given to the locomotive which produces the tractive effort called for with the least weight.

COMPARISON OF WEIGHT AND POWER LOCOMOTIVE

The single-phase locomotives now building are described as being composed of two identical smaller locomotives, each one having the following characteristics:

Total weight 62 tons.
Three driving axles with all the weight on drivers.
Diameter of driving wheels 62 ins.
Three driving motors, one geared to each axle.
Weight of three motors 43,500 lbs.
Each motor wound for 240 volts and 25 cycles per second, and to be operated with auto-transformers having 50-volt taps.
Forced ventilation.
Total weight of electric equipment estimated at about 30 tons.

For three-phase operation, single unit locomotives would be the best solution, but in order to make the comparison strictly fair in every respect I have calculated on three-phase locomotives also composed of two identical smaller locomotives, each one built according to the following data:

Total weight 50 tons.
Three driving axles with all the weight on drivers.
Diameter of driving wheels 62 ins., although smaller wheels could readily be used if desirable.
Three driving motors, one geared to each axle.
Weight of three motors 33,000 lbs.
Motor stators wound directly for 3000 volts, rotors for 250 volts.
Natural ventilation.
Total weight of electric equipment about 22 tons.

From these figures it will be seen that it is easily possible to design a three-phase locomotive which will have the required capacity for hauling a 1000-ton train under the above mentioned conditions, within the specified maximum weight of 140 tons. As a matter of fact, it would be possible to design such a locomotive within the minimum weight of 100 tons, but this latter weight has to be used in order to provide for the necessary adhesion between locomotive and track when going up the 2 per cent grade.

In any event, it is worth noting that the three-phase locomotive can easily be designed with 20 per cent less weight that the single-phase locomotive. Furthermore, it may be pointed out that the three-phase locomotive will develop its rated output continuously with natural ventilation, while the single-phase locomotive will use forced ventilation for this purpose. Forced ventilation is not, in itself, seriously objectionable, although it naturally makes the equipment slighly more complicated. But, if forced ventilation were employed for the three-phase locomotive, its power could readily be further increased. In other words, the three-phase locomotive is without question not only very much lighter, but also very much more powerful than the single-phase locomotive.

COMPARISON WITH REFERENCE TO SCHEDULE SPEED

Unfortunately, the curve diagram published in the article of Jan. 20 does not contain any speed-time curves. Nevertheless, careful analysis shows that the single-phase locomotive will make the run about as follows:

It will accelerate on the level from zero to a speed of about 12 miles per hour during 2 minutes. It will then coast down grade on the brakes at about 14 miles per hour. On the level track it will slow down to a speed of about 11 miles per hour and it will run up the grade at that speed. After reaching the summit on the far side it will accelerate during about 85 seconds up to a speed of about 13.5 miles per hour and it will run at that speed to the terminal. This performance is indicated in Fig. 2.

There are several schedules which would be better suitable for a three-phase locomotive, but it is possible to make absolutely the same run by using three motors of four, eight and ten poles respectively. The three-phase locomotive would then accelerate during 2 minutes from zero up to the same speed of about 12 miles per hour. In passing over the summit it would still further increase this speed up to about 14 miles per hour, and it would then start to coast down the grade at about 14.6 miles per hour, at which speed it would return energy to the line. When reaching the level stretch it would stop returning energy and would coast down to about 11 miles per hour, at which speed it would ascend the grade. After passing the summit on the far side, and when the entire train is on the level, it would during 45 seconds accelerate up to about 13.5 miles per hour, at which speed it would run into the terminal. This run is also indicated in Fig. 2.

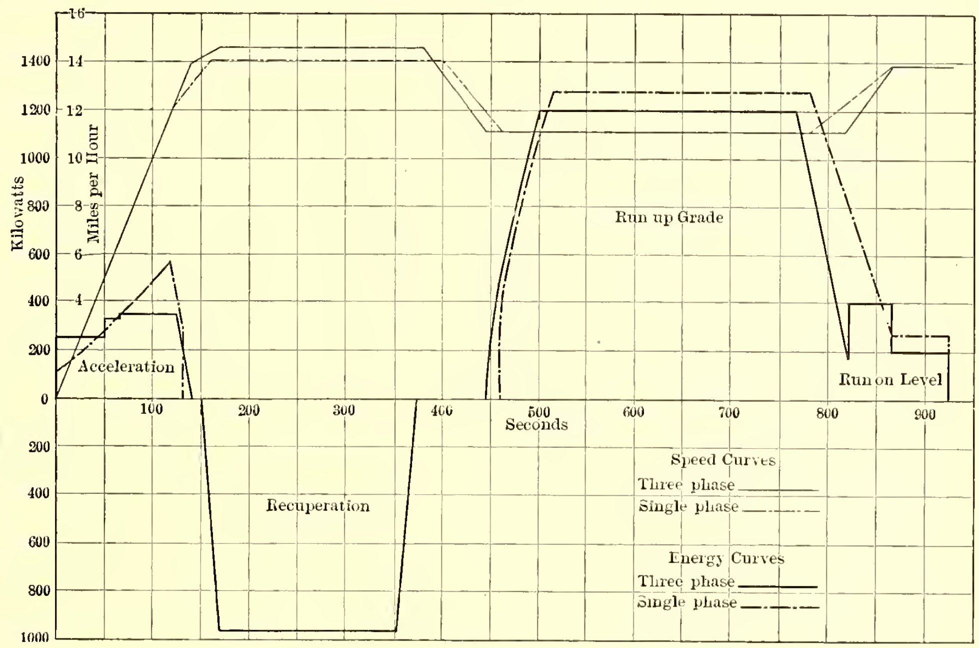


FIG. 2.—SPEED-TIME AND ENERGY CURVES

Speed regulation was quite clearly stated to be of "overwhelming importance" in the case of the Sarnia tunnel equipment, but it is readily seen that this condition can easily be fulfilled by the three-phase locomotive, and the following remarks will show that it can adhere to the schedule proposed at a considerably better efficiency than the single-phase locomotive.

COMPARISON OF ENERGY CONSUMPTION

It may appear startling, or at least unexpected, to hear me say that the three-phase locomotive will use less energy to perform this service than the single-phase locomotive. Nevertheless, this seems to be actually the case and it appears to be so, even if we leave out of consideration entirely the question of recuperation of energy on the run down grades.

Fig. 2 shows the energy required by the single-phase locomotive for one complete run as taken from the curve diagram contained in the article of Jan. 20. The same figure shows the energy consumed for the same run by the three-phase locomotive.

The scale for the curve contained in the article of Jan. 20 is such that an accurate determination of the energy required by the single-phase locomotive is made difficult. But this energy can nevertheless be said to be not less than 508,000 kilowatt-seconds for the entire run, of which 43,500 kilowatt-seconds are consumed during the start and about 464,500 kilowatt-seconds during the run up grade and into the terminal.

The three-phase locomotive, by the use of concatenated control during the start, would require for the starting about 41,800 kilowatt-seconds, and for the rest of the run, due to the considerably higher efficiency of the three-phase induction motor, about 422,500 kilowatt-seconds. The total for the entire run would therefore be about 464,300 kilowatt-seconds.

While the energy consumption of the single-phase locomotive for one run is thus found to be about 141.3 kilowatt-hours, the three-phase locomotive will require only 129 kilowatt-hours, and the difference of 12.3 kilowatt-hours represents the saving which will be made during each run, by the three-phase locomotive.

In addition to this, the three-phase locomotive, on running down the grade, is capable of returning energy to the line at the rate of 960 kw, or a total of about 197,200 kilowatt-seconds, or 54.8 kilowatt-hours for each run.

MAXIMUM POWER CONSUMPTION

There is also quite a difference in the maximum power required by the two types of locomotives, and consequently in the maximum peak on the two systems.

From the curve published in the article on Jan. 20, the maximum power required by the single-phase locomotive when running up the two per cent grade appears to be about 1280 kw, and the maximum power required during the starting period about 570 kw. The maximum peak represented by a combination of two locomotives, one starting while the other is running up the grade, is therefore about 1850 kw.

The published efficiency of the single-phase motor is 86 per cent when running under full load at normal speed. The induction motor when running under full load at normal speed has an efficiency of at least 92 per cent. The maximum power required by the three-phase locomotive when running up the 2 per cent grade will therefore be only 1200 kw, and the maximum power required during the starting period is found to be about 350 kw. This makes the maximum peak on the three-phase system, due to one locomotive starting, and another one running up the grade, about 1550 kw or about 20 per cent less than the maximum peak in the single-phase system.

COMPARISON OF COST OF INSTALLATION

The first cost of installation will be made up in each case by the cost of the locomotives, the cost of the line equipment and the cost of the power house.

The three-phase locomotives were found to weigh about 20 per cent less than the single-phase locomotives and, inasmuch as three-phase motors are, if anything, less expensive to build than single-phase motors, it is not unfair for the purpose of this comparison, to assume that the cost of the two types of locomotives is more or less proportionate to their weight. There is therefore a saving of about 20 per cent in the cost of locomotives in favor of the three-phase system.

The line equipment will consist, with the single-phase system, of one No. 0000 copper wire for each track throughout the electrified section. The three-phase system will require two No. 0 copper wires for each track. The amount of copper is therefore almost identical in the two cases, but the three-phase system will require more insulating material and, perhaps, somewhat heavier suspension, which will undoubtedly increase the cost of the line equipment of the three-phase system to a certain extent.

This increase will, however, be much more than offset by the decrease in the cost of the power station. The single-phase power house will contain two turbo-generator units of 1250 kw each. The maximum load on these generators is represented by the above mentioned maximum peak of about 1850 kw plus about 760 kw of lighting and pumping load, or a total of about 2610 kw. Of this load only the last 760 kw will be equally distributed over the three-phases of the generators, while the 1850 kw will be placed on two phases only, as an interconnected single-phase load. The maximum load on one-phase is therefore one-third of 760 kw plus one-half of 1850 kw, or about 1175 kw, which corresponds to an overload of about 41 per cent over the normal rated load of two 1250 kw three-phase generators. The three-phase system will have a maximum load of about 2310 kw, consisting of the maximum peak plus the same 760 kw for lighting and pumping. All of this load is equally distributed over the three phases of the generators. If we calculate with the same overload capacity of 41 per cent as we did in the case of the single-phase system, we find that the three-phase load can be readily carried by two three-phase generating units of 800 kw each. Instead of a power house of 2500 kw capacity we therefore have one of 1600 kw capacity.

It is not very easy to calculate the exact amount thus saved in the first cost of installation by the use of the three-phase system, but the above considerations show that this saving will amount, at the very least, to say $100,000 out of a total first cost which will be somewhere in the neighborhood of $500,000.

COMPARISON OF COST OF OPERATION

We have seen above that one three-phase locomotive will save in one run with a 1000-ton train, 12.3 kw-hours. The traffic to be handled at present consists of about 12,000 such runs per year. The direct saving in energy effected by the three-phase system is therefore 12,000 x 12.3 kw-hours, equal to 147,500 kw-hours per year. With a variable load of the character under consideration the value of kw-hour will not be less than 1c., and the annual saving can therefore be expressed by the figure $1,475.

As shown above, the three-phase locomotive is capable of returning during one run 54.8 kw-hours. For 12,000 runs there would be 12,000 x 54.8 = 658,000 kw-hours per year, which can be returned to the power station. Unfortunately, not all of this energy can be usefully employed, inasmuch as it is returned at the rate of 960 kw, while there is never a simultaneous demand for such an output. It is possible, however, to utilize part of this energy for trains starting in the opposite direction, which would require, say, an average of 300 kw. Furthermore, there is a steady load on the power station in the shape of the lights in the tunnel and the drainage pumps. This lighting and pumping load will at some time during the day amount to 760 kw, and it is pretty safe to assume that the average of this load will be in the neighborhood of 400 kw. Finally, there are a few motors in the locomotive repair shops which also consume about 70 kw, and it would seem more than likely that a diligent search would show that further similar motors can be found and made useful. All in all, of the 960 kw at least one-half can certainly be utilized and the energy thus recuperated corresponds to 329,000 kw-hours per year. At 1c. per kw-hour this amounts to a further saving of $3,290.

The total energy consumed each year by the single-phase system is 12,000 x 141.3 = 1,695,600 kw-hours. At 1c. per kw-hour, this energy would cost $16,956. The total saving made by the three-phase system is $1,475 plus $3,290, or $4,765, which is 28 per cent of the total cost of energy.

In the cost of maintenance and repairs there will probably also be a certain difference, but this difference is not easily expressed in figures. Whatever additional amount may be due to the maintenance of 4 miles of second overhead wire will certainly be more than counterbalanced by the additional cost of repairs to the commutators of the single-phase motors. Actual data on this subject is lacking, however, and it may be well for the present to take the cost of maintenance and repairs as being the same for the two systems.

The amount to be set aside for interest on the investment will be smaller in the three-phase system by the interest on whatever amount will actually be saved in first cost of installation. If we take this amount, as above, at $100,000, and interest at the rate of 5 per cent, there will be a further saving of $5,000 per year to be credited to the three-phase system.

ADDITIONAL ADVANTAGES OF THREE-PHASE SYSTEM

The question of saving in operating expenses might not in itself be decisive, if there were any special disadvantages connected with the three-phase system. Such is, however, not the case. On the contrary, there are several advantages connected with this system which may prove to be of considerable importance.

The less weight of the locomotives, pointed out above. was clearly stated in the specification to be advantageous. It will readily be seen that with about 50,000-locomotive miles per year a difference of weight of 24 tons per locomotive will represent an appreciable saving in ton miles.

The specification also contained the condition that the locomotive must be capable of starting a 1000-ton train on the 2 per cent grade, and this condition is without question better fulfilled by the three-phase than by the single-phase locomotive. The single-phase motor has an inherent defect in that it cannot while standing still, develop anything like its full torque for any length of time, because the brushes are in this case short-circuiting one of the rotor windings and the current induced in this winding would in a few seconds destroy it. The three-phase motor, on the other hand, can develop its full torque standing still for a practically unlimited time. The advantage presented by this fact will be duly appreciated if it is taken into consideration that the locomotive, when starting on a grade, must exert its full drawbar pull for a certain time before the brakes on the train can be opened.

Among the minor advantages of the three-phase system may be mentioned its absolute and automatic maintenance of schedule speed, and the better balancing of the entire system. This better balancing will certainly improve the lighting as well as the operations of the motors, both of which cannot help but be affected by the throwing on and off of unbalanced loads of 1300 kw, as is done in the single-phase system.

All in all, I believe that the figures and facts brought out during this investigation in the Sarnia tunnel case, which case as such is not at all favorable to three-phase operation, will conclusively show that the three-phase alternating-current system has decided merits of its own, and that it will pay everybody engaged in this line of work to carefully look into these merits. This is what I set out to demonstrate.

[Mr. de Muralt's article was submitted before publication to B. J. Arnold, consulting engineer of the Grand Trunk Railway for this installation, and he replies to the points mentioned by Mr. de Muralt in the following letter.—Eds.]

New York, Feb. 15, 1906.

Editors Street Railway Journal:

I have read with a great deal of interest Mr. de Muralt's article on the St. Clair or Sarnia tunnel installation, which you have been kind enough to allow me to read before its publication.

Inasmuch as the article reached me just as you are about to go to press, I have not time to enter into an analysis of Mr. de Muralt's figures, and shall assume that they are correct, for the entire tone of the article is such as to command respect. It shows that the author is trying to bring out engineering facts instead of endeavoring to get into a controversy. I am glad to have any fair-minded comment and criticism upon this installation, and I consider this such a criticism. But I cannot concur in all of Mr. de Muralt's conclusions, for I believe that some of them are based upon wrong premises. I feel that if he had had before him all of the conditions which governed the choice of apparatus, especially as regards cost, his conclusions in regard to the economies he shows would have been different. I cannot in the short time at my disposal enter into an extended discussion of the relative merits of single-phase and three-phase equipment. I fully recognize that there are conditions under which the three-phase system can show advantages so far as economy of operation is concerned, but in deciding upon the type of apparatus to adopt for a given installation there are many things to be taken into consideration aside from operating efficiency. Not the least of these are: first cost of installation, the commercial availability of the apparatus and convenient access to the manufacturer furnishing it. These three points will generally govern where the difference in efficiency of operation between systems is small.

Mr. de Muralt's economy in operation practically disappears in the St. Clair installation when it is stated that the pumping load, assumed by him to be an average of 400 kw throughout the year, is only in operation for a few hours during a heavy rainstorm or while snow is melting and running into the tunnel. This condition exists only on a few days in the year, and for the rest of the time the pumping load averages about six horse-power. This load, when combined with the lighting load of the tunnel and small shop-motor load, is by no means large enough to absorb the recuperated energy of a train when descending a grade. Hence energy gained by recuperation would have to be dissipated most of the time through water rheostats or metallic resistances, because it is not possible in this installation to have a train ascending and another descending at the same time.

The only practical way of utilizing this energy is by means of a battery auxiliary which will store the kinetic energy of a descending train so that it may be given out at the time another train may be ascending. If there is any advantage to be gained by such a plan, it is not improbable that the single-phase motor may be able to supply it, although this subject is as yet in an experimental state and we must admit that the three-phase motor has this advantage at present. Provision has been made in the St. Clair installation to install a battery and an inverted rotary for recuperating energy and equalizing the load on the power house should conditions ultimately seem to warrant it. Such an installation cannot be justified from the standpoint of economy in operation at present prices, and the provision for its future installation was mainly for the purpose of adding to the reliability of the system in case it should be found necessary. For the present time it was considered better to assume this risk than to incur an investment which can be made at any time with equal facility.

Regarding the first cost of single-phase and three-phase installations, I can only say that while I have been led to believe that three-phase railroad equipment could be purchased for about the same cost as direct-current equipment, and therefore for less than single-phase equipment, when bids were asked for an installation of considerable magnitude upon a road with which I am connected, the tenders for the three-phase installation taken as a whole were much higher than those of either the direct-current or single-phase installations. All were based upon the same specifications as to requirements, and were for delivery in a country where the duty was somewhat in favor of the manufacturers of three-phase apparatus. I presume that if three-phase apparatus was manufactured in this country, this condition would not hold, but this was the situation that confronted those who had to make the decision for the St. Clair tunnel installation. I do not wish to be understood as opposed to the three-phase system where conditions are favorable for its adoption and where the additional overhead work required by it can be allowed, but taking the physical conditions of the St. Clair tunnel and the business conditions as I found them in this country, I feel that my clients' interests are safely preserved as the matter stands. Bion J. Arnold

The improvements made a few months ago by the Cleveland & Southwestern Traction Company, which included reballasting some of its lines and the installation of fifteen new cars with high-speed limited service to Wooster and Norwalk, has resulted in a tremendous increase in business, the showing for the month of January being $12,000 gross greater than the corresponding month last year.

THE SNOW PROBLEM IN MARQUETTE

BY HAMILTON BALUSS,
General Manager Marquette City & Presque Island Railway Co.

Thinking that the methods pursued by one street railway in combatting the snow problem might be of interest to others, an endeavor will be made to outline the way in which this is being done by the Marquette City & Presque Isle Railway. In this part of the country the snowfall is very heavy. It generally begins some time in November, and falls varying

TYPICAL STREET SCENE IN MARQUETTE DURING WINTER

from a few inches to 2 ft. or more on the level may be expected every few days until the first part of April. The snow also drifts readily, and drifts several feet deep are common. Whatever snow falls during the winter does not usually melt until spring.

To prevent the drifting of snow upon our tracks, we use a considerable amount of snow fence, so constructed that it

SIDE PLOW BEFORE BEING ATTACHED TO SWEEPER

can be folded up and stored when not needed. It is placed at as many points as possible where the snow drifts, and is securely anchored. It is built in sections about 14 ft. long and 5 ft. high, and 4-in. spaces are left between the boards. These spaces render the fence much more effective than if it was boarded up solid. The fence is placed to the windward about 75 ft. from the track. Experience has shown that it should not be placed nearer to the track, as in that case it will not have the desired effect. A fence of this kind properly made will prevent drifting. All bushes within 20 ft. of the track should be kept cut down, as they are drift producing.

The only equipment for fighting snow which required the outlay of any considerable amount of money on our road was a snow sweeper, which was purchased without motors, controllers or wiring. An old discarded motor is used to run the brooms, and the necessary wiring was cleated on the inside of the car so as to be away from the snow and wet. In the fall, when the summer cars are laid up, the motors from

HOME-MADE SNOW PLOW, MARQUETTE

one of them are placed under the sweeper. The sides of this sweeper carry the ordinary adjustable wings. This sweeper is used to keep the city streets open during a storm. It is in charge of an experienced man, and carries sand, salt and all tools necessary for removing snow and replacing cars.

Perhaps it would be well at this point to explain that the removal of snow and the duty of keeping switches open fall

SIDE PLOW ATTACHED TO SWEEPER, REAR VIEW

upon the section crew. All of these men are taught to handle a car, to perform the duties of a wrecking crew and the proper way to handle snow removal apparatus. In case of a storm, there is no delay, but a start is made as soon as it is apparent that trouble may result. The snow is removed from the track before it has time to accumulate. In this way the cars seldom fail to keep up to the schedule, even during a storm.

The first effort is merely to keep the track open. Outside the city a snow plow is used; in the city, the sweeper. The snow is thrown as far back as possible with the sweeper wings. Care is always taken to sweep the snow in the same direction as the wind is blowing. As soon as the track is swept clean, the brooms are raised and the sweeper is run over the track in each direction and the snow is crowded as much further back with the wings as is possible.

After this, the side plow, shown in one of the accompanying illustrations, is attached to the side of the sweeper at right angles by special braces provided for this purpose. The side plow is triangular in shape. The side next to the sweeper is 13 ft. long, the outside is 20 ft. in length and its extremity is 10 ft. 4 ins. from the side of the sweeper. The width of the outer board for the first 12 ft. is 1 ft.; the balance is 2 ft. in width. The side plow is built of oak, tied with iron rods, and the cutting edge is faced with iron. It is very strong. One man built it in about six hours. The nose is attached to the plow by a chain. The outer end of the plow is maintained at any desired height, or can be raised to pass any obstruction, by means of a double pulley block connected to the side of the car. The side plow will move 10 ins. or 12 ins. of snow back from the side of the car for 10½ ft. at a speed of 6 m.p.h. to 8 m.p.h. It will crowd back a bank of snow 6 ft. wide at the base and 4 ft. or 5 ft. high, which would seem at first thought well-nigh impossible of removal by this means.

It leaves a clean driveway over 10 ft. wide on either side of the car, and as smooth as a floor. As about 4 ins. of hard snow is left on this strip, the sleighing is better than on the uncleaned streets. Of course, it is often necessary to haul away a certain amount of snow which has piled in front of

SCRAPER USED FOR CUTTING DOWN RIDGE BETWEEN RAILS

stores and at crossings. When pushing back the first few falls of snow with this plow, a block 12 ins. x 12 ins. and about 2 ft. long is placed endwise between the rear end of the side plow and the braces on the car; this throws the first snow 12 ft. from the car. Later on the block is turned the other way, which throws the snow back 11 ft. Afterward the block is removed altogether. These changes are made according to circumstances.

In a place where there is much snow, this side plow is about as useful a piece of apparatus as is made. After a street is cleaned in this manner it is as though no snow had fallen, in so far as respects the removal of snow from subsequent storms.

It often happens from various causes that snow and ice pack between the rails to form a ridge, on which the motor castings drag. The ordinary plow or sweeper is unable to cut this ridge out. The operation of a sweeper is seriously affected by this ridge, as the wheels run in a sort of groove, from which the sweeper cannot properly remove the snow without soon destroying the brooms, if at all. It therefore becomes highly desirable to cut this ridge down. To do this a heavy road scraper with wheels the same gage as the track was taken and a heavy flange was bolted on each wheel, so that it would run on the track like a car. A piece was then fastened on the end of the tongue so that the wagon could be drawn by a car. After this it was weighted down with iron. This scraper, which is illustrated, removes the hard ridge between the rails and about a foot on each side, and can be made to cut down as low as desired. Once over the road is usually sufficient; more than two trips are never required. The scraper is drawn at a speed of about 5 m.p.h.

When the snow is too deep to use a sweeper successfully, and for work outside the city, a home-made plow is employed. The illustration shows its general construction. The plow is faced with No. 12 sheet iron, underneath which is a backing of 2-in. planks, well braced. The trucks and motors are taken from a summer car. The plow is weighted with as much rail and iron as it will safely carry. It can open a road through drifts 5 ft. deep. All gongs on the plow and sweeper are on the roof, where they will not get clogged with snow.

Salt and sand are used as sparingly as possible. There is one very heavy grade on the road, and if salt is used on this grade it is impossible for a long time to get the rails in good condition so that the wheels will cling to them as well as they did before. The best results on this grade are obtained by using no salt and using sand only when absolutely necessary. A very little salt is used on switch points and special work when they cannot be kept open otherwise. Our experience leads us to consider salt as injurious to both track and equipment, especially to motors and wiring.

In addition to the apparatus previously described, all cars are provided with good scrapers.

TROLLEY BASEBALL LEAGUES

Interurban roads in Ohio are finding that the interest in baseball in small towns is growing, and that one of the best possible means of inducing summer traffic is the formation of, or lending assistance to, semi-professional or professional clubs in the villages along their lines. In a few instances roads have attempted to manage clubs and conduct the parks, but usually it has been found just as satisfactory to allow others to manage affairs and to confine themselves to assisting in advertising and providing transportation for the public, or perhaps donating a cup or cash prize for the championship. Where there are close contests, a local pride is developed, and if distances are not too great or rates too high, there is apt to be a great deal of traveling between towns, and in such cases the roads can well afford to transport the players free. Trolley leagues are now being formed by the Pennsylvania & Mahoning Valley, the Cleveland & Southwestern, the Pennsylvania & Ohio and Lake Shore Electric roads.

MUTUAL BENEFIT ASSOCIATION IN MONTREAL

The development of provident and benefit associations among electric railway employees may now be regarded as a well-defined phase of electric railway management. When properly directed and handled, associations of this kind exert a powerful influence toward bringing public service corporations into that close, harmonious and co-operative relation with their employees which is so essential to the successful administration of quasi-public services.

The Mutual Benefit Association as maintained by the officers and employees of the Montreal Street Railway Company is an excellent illustration of the good results that can be accomplished by an organization of this nature properly handled.

In 1903 the employees of the Montreal Street Railway Company, in conjunction with the management, took in hand the organization of the Montreal Street Railway Mutual Benefit Association, which for actual benefits accruing to its members at a minimum of cost, and the establishment of mutual co-operative relations between company and men, probably eclipses anything of its kind here or elsewhere. The association was inaugurated in August, 1903, at a conference between delegates appointed by the employees, who met the officials of the company, and as a general plan had already been suggested, it was not long before a complete organization was reached. Rules and regulations were drawn up, and these were submitted at a general meeting and approved, after which a board of directors was elected and medical officers appointed.

Every possible means was taken to place the idea clearly

Name ....

Occupation ....

Dep't ....

Age........Date of Entry in Company's Service..............................

Admitted a Member..

Why not a Member?..

....

....

Remarks ....

....

....

Date..........................190 ....

FIG. 1.—CARD INDEX OF ALL EMPLOYEES, KEPT IN OFFICE OF MUTUAL BENEFIT ASSOCIATION

Claim No.

MONTREAL STREET RAILWAY MUTUAL BENEFIT ASSOCIATION

Notice of Disablement and Application for Sickness or Bodily Injury Benefit.

MONTREAL, ... 190

To the Head of Department:

I .... Badge .... residing at .... and employed as .... in .... Department and holding certificate No. .... hereby certify that I was compelled to quit work at .... o'clock on the .... 19 , on account of (state nature of sickness or injury) ....

....

....

....

which rendered me totally unable to continue my usual duties.

....

Disabled Member.

Referred to Secretary-Treasurer.

....

Head of Department.

REMARKS:

....

....

....

This blank is to be filled out by any member who is unable to perform his usual duties on account of sickness or bodily injury. No claim for benefits will be considered unless this notice properly filled and approved by Head of Department, has been received promptly by the Secretary-Treasurer. Full address and correct time of disability must be given.

FIG. 2.—BLANK ON WHICH MEMBER APPLIES FOR BENEFITS IN CASE OF SICKNESS OR INJURY

MONTREAL STREET RAILWAY MUTUAL BENEFIT ASSOCIATION

OFFICE OF THE MEDICAL OFFICER

HOCHELAGA DIVISION, ... 190

To the Secretary-Treasurer
of the Montreal Street Railway Mutual Benefit Association

I Hereby certify that on the .... day of .... 190 .... attended Mr. .... of .... for illness or accident and at various times between the said .... day of .... 19 , and the .... day of .... 19 , and that the nature of symptoms which were present during his disability where as follows:

....

....

....

....

and that he was in consequence thereof confined to the house for .... days, and is at present .... recovered and .... able to resume his usual occupation.

....

Medical Officer.

I hereby certify that the above party was not at work during the time mentioned hereon.

....

Head of Department

FIG. 3.—MEDICAL OFFICER'S REPORT ON APPLICATION FOR BENEFITS

before the employees, and within three months of the time that the association was formed there were 600 members on the roll, while now there are upward of 1700 members in good standing, or practically all the employees eligible for membership. The president of the association is D. McDonald, who is general manager of the Montreal Street Railway Company, and the secretary-treasurer of the association is Patrick Dubee, who is also secretary-treasurer of the company. The affairs of the association are directly in charge of a "committee of management," composed of fifteen members, who are drawn from the various departments, so that each grade of employees is properly represented.

Montreal Street Railway Mutual Benefit Association

Office of the Secretary-Treasurer

MONTREAL, ... 190

Mr. ....

Please note that the following members in your Department have reported themselves as sick. You will oblige by calling on them and advising us hereunder as to their condition together with any suggestion you might recommend.

Claim No.	NAME	Badge No.	ADDRESS	REMARKS

PATRICK DUBEE,
SECRETARY-TREASURER

FIG. 4.—REPORT OF HEAD OF DEPARTMENT ON CONDITION OF EMPLOYEES MAKING APPLICATION FOR BENEFITS

Cert. No.	Name	Dept.	No.
Date	Age	Period in Cor's Service ...... years ...... months	

	PAYMENTS													Expenses	Surplus
	Jan.	Feb.	Mch	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total		
1903															
1904															
1905															
1906															
1907															
1908															
1909															
1910															
1911															
1912															

Remarks

FIG. 6.—FACE OF CARD LEDGER FOR KEEPING ACCOUNT WITH EACH MEMBER

Membership in the association is open to every official and employee of the company, including office force and all of the mechanical and operating departments who can pass a satisfactory medical examination.

The object of the association, as declared in the rules and by-laws, is to afford relief to the employees of the company, as follows:

(a) By providing means of subsistence for the members who become unable to serve the company through illness or bodily injury, including the paying of medical and other expenses;

(b) By providing an allowance to the widow or children or representatives of the deceased member;

(c) By providing a pension for old and disabled members.

The sick benefits are as follows:

In case of sickness or disablement, after the first six days the member receives 60 cents per day for ninety days, and 30 cents per day for the next ninety days, also free medical attendance and free medicine. Membership also secures 20 per cent discount on all medicines or druggist supplies required by members of the family.

The insurance feature includes a life insurance policy for $500 and an additional $50 toward the cost of funeral expenses.

The pension benefit insures to every member who leaves the service of the company after the age of sixty-five years, and who has been in the service for a period of twenty-five years, a pension of 50 cents per day during the remainder of his life, and any member permanently disabled from earning his livelihood in any position from injury received while actually at work in the service of the company is entitled to a pension at the rate of 50 cents per day after the first six months of disablement.

Montreal Street Railway Mutual Benefit Association

OFFICE OF THE SECRETARY-TREASURER

MONTREAL, ... 190

Summary of Medical Officers' Reports of the 190

DIVISION	VISITS	CONSULTATIONS	PRESCRIPTIONS	MEMBERS DISABLED	REMARKS
Central					
Hochelaga					
St. Denis					
St. Henri					
Total....					

No. of Applicants examined by Chief Medical Officer ....

CORRECT

SECRETARY-TREASURER. CLERK.

FIG. 5.—SUMMARIZED REPORT OF VISITS AND CONSULTATIONS MADE BY MEDICAL OFFICER

PAYMENT OF BENEFITS

Mo.	Yr. No.	Amount	Month	Yr. No.	Amount	Month	Yr. No.	Amount	Month	Yr. No.	Amount

FIG. 7.—REVERSE OF CARD LEDGER SHOWN IN FIG. 6

All of these benefits are secured for the sum of $1 initiation fee and 50 cents per month for each member.

The funds of the association are derived from two sources, namely, the dues of members and contributions from the Montreal Street Railway Company, the company agreeing to contribute annually a sum not less than 50 per cent nor exceeding 100 per cent of the annual contributions made by members in the form of dues. The company has been very liberal in this regard, and by generous contributions enables the association not only to pay all its liabilities, but to lay by a substantial surplus for future requirements. From the last annual report of the association for the year ending April 30, 1905, the receipts from members amounted to $8,800; donations and fees from the company, $12,000; receipts from picnic, $1,300; receipts from interest, etc., $215, making total receipts of approximately $22,400. The expenses for sickness and injury, medicine, death and burial, medical attendance and management were $18,850, leaving a surplus of approximately $3,550. A report of the various calls made upon the association for relief work was published in the STREET RAILWAY JOURNAL for Sept. 23, 1905, page 451. The number of members disabled through sickness or injury was 611; number of prescriptions issued, 2864; visits made by association physicians, 692; consultations given by physicians, 4026.

A special feature is made of the annual picnic, which is always considered a "red letter day" in the affairs of the company. Athletic games are held and special prizes are given. At the picnic last year the association cleared over $1,000, which went to the benefit of the treasury. It is stated by the officers of the Montreal Street Railway Company that the association has been of the greatest value in bringing the employees together socially, in increasing the fraternal feeling between officials and employees, and in making the men and their families happy and contented and loyal to the service.

Montreal Street Railway Mutual Benefit Association.

Claims for Benefits submitted this .... day, the 190

CLAIM No.	NAME	OCCUPATION	Certificate No.	NATURE OF DISABLEMENT	No. of days Disabled	No. of days entitled to Benefit	AMOUNT OF BENEFIT	REMARKS

FIG. 8.—HEADING OF DAILY DISBURSEMENT SHEET, SHOWING PAYMENTS MADE BY THE ASSOCIATION

Montreal Street Railway Mutual Benefit Association

OFFICE OF THE MEDICAL OFFICER

Montreal, ... 190

To the Secretary-Treasurer of
MONTREAL STREET RAILWAY MUTUAL BENEFIT ASSOCIATION

I beg to advise you that the following members of the Association have been seen by me to-day, and now report on their respective cases as under:

NAME	BADGE No.	DISABLED	PRESCRIPTIONS	REMARKS
Called upon the following Members at their Homes				
Applicants examined				
Consultations at the Office				
No. of Disabled Members:				

MEDICAL OFFICER

FIG. 9.—DAILY REPORT MADE BY EACH MEDICAL OFFICER EMPLOYED BY THE ASSOCIATION

Montreal Street Railway Mutual Benefit Association

Employees Discharged, Resigned, Etc. .... Department.

Men Discharged or Resigned for Month ending 190

NAME	OCCUPATION	REASON

New Men taken on for month ending 190

NAME	AGE	ADDRESS	OCCUPATION	SHOP

Men Changing Position for Month ending 190

NAME	FROM PRESENT OCCUPATION	TO	REMARKS

FIG. 10.—BLANK USED FOR NOTIFYING THE BENEFIT ASSOCIATION OF CHANGES IN PERSONNEL OF EMPLOYEES MADE BY OPERATING DEPARTMENT

The system of blanks used in carrying on the work of the benefit association is exceedingly complete. As a basis of all the records, a card index is kept (see Fig. 1) which gives the name and occupation of every employee in the company's service, together with a notation as to whether the employee is a member of the benefit association or not, and if he is not a member, the reason why he has not joined.

In order to become a member of the association, the applicant must fill out an application blank, by signing which he promises to conform to and abide by all the rules and by-laws of the association. In this blank he also gives the name of the beneficiary who is to receive the benefits of the insurance in case of the decease of the member. After signing the application blank in the presence of witnesses, the applicant must pass an examination by the chief medical officer of the association, from whom he must obtain a medical certificate testifying that the applicant is in good state of health and not afflicted with any disease, disorder, habit or bodily health tending to shorten life or to incapacitate him from the performance of the duties required in the service of the company. If the application and the medical examination are approved by the proper committee, his certificate of membership is issued. If a man is taken sick or disabled, he makes application for sickness or bodily injury benefit on form Fig. 2. When a claim is received at the office of the association it is immediately assigned to one of the association physicians, who takes charge of the case, making as many professional calls as may be necessary and prescribing the proper remedies. The physician reports his record of the case on the form Fig. 3.

As an additional check and safeguard, when a claim for relief is received the head of the department in which the employee is engaged is notified and takes immediate steps to find out the exact condition of the applicant. For handling this phase of the work the form Fig. 4 is used.

The medical officers make summarized reports of visits and consultations on form Fig. 5.

By an ingenious card ledger system a separate account is kept between the association and each individual member. The individual accounts are kept on single cards, the face and reverse of which are shown in Figs. 6 and 7. The face of this card gives the name and other information concerning the member, and contains columns in which are entered a record of all payments for dues. In connection with the columns for recording payments of dues, there is a column headed "Expenses," in which is entered any sum that may be paid to the member in the way of sick or injury benefits, so that the face of the card always shows the balance of dues over benefits, or vice versa, for each member. On the reverse side of the card is kept a detail record of payments made to the member in the form of benefits, the columns being ruled to show month, voucher number and amount. The one card therefore serves for all the accounting between each member and the association.

On a blank, the headings of which are reproduced in Fig. 8, are entered each day the sums paid as claims for benefits, and this forms the daily disbursement sheet of the association. Fig. 9 is a blank upon which each medical officer makes report of his work for each day, giving the history of the respective cases. Fig. 10 is a form used by the operating department for notifying the benefit association regarding men discharged or resigned, new men taken on or transferences from one department to another. By means of this information the association is enabled to keep its card index of employees previously mentioned always correct and up to date.

UNIQUE ADVERTISING AT CLINTON, IOWA

Few roads give as much thought to the real promotion of passenger traffic as does the Iowa & Illinois Railway, of Clinton, Iowa. P. P. Crafts, general manager of the company, has inaugurated a thorough system of advertising which has proven most beneficial.

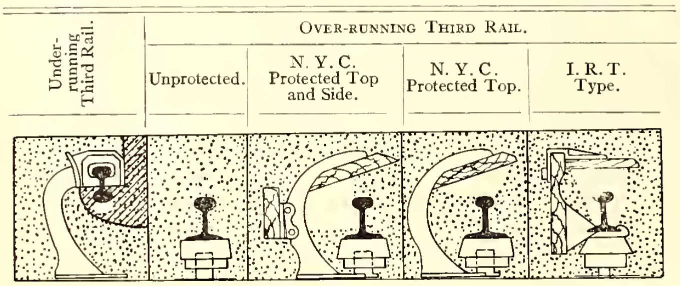
Special attention has been given to methods for attracting

SOME TYPICAL ADVERTISING CARDS OF THE IOWA & ILLINOIS RAILWAY

the patronage of commercial travelers, who constitute a large, if not a major, portion of travel on our steam railroads. Large square or round advertising cards, some 6 ins. in diameter, can be seen in almost every hotel, railway station and public place in Iowa and Eastern Illinois, calling attention of the commercial traveler to the fact that the road is in existence, that baggage is carried free, and the many ways in which the electric service would be to his benefit. In Davenport, Rock Island and at other points on the line, these cards, with various literature, may be seen in shop windows, stores, restaurants, billboards and, in fact, at every point of view encouraging the riding of the hunter, fisherman, pleasure seeker, excursionist, business man and all other classes of possible passenger traffic.

TESTS OF THE EFFECT OF SNOW ON THIRD-RAIL

The heavy snow storm of last week allowed the electrical engineering department of the New York Central & Hudson River Railroad to conduct some interesting tests on the effect of snow on different forms of third rail. As is generally known, the New York Central & Hudson River Railroad Company has equipped a section of its line some 6 miles in length, between Schenectady and Amsterdam, with three different types of third rail, and it is upon this section that electric locomotive No. 6000 is being put through its 50,000-mile run. This section is equipped with three different forms of third rail; viz., (1) the ordinary over-running unpro-



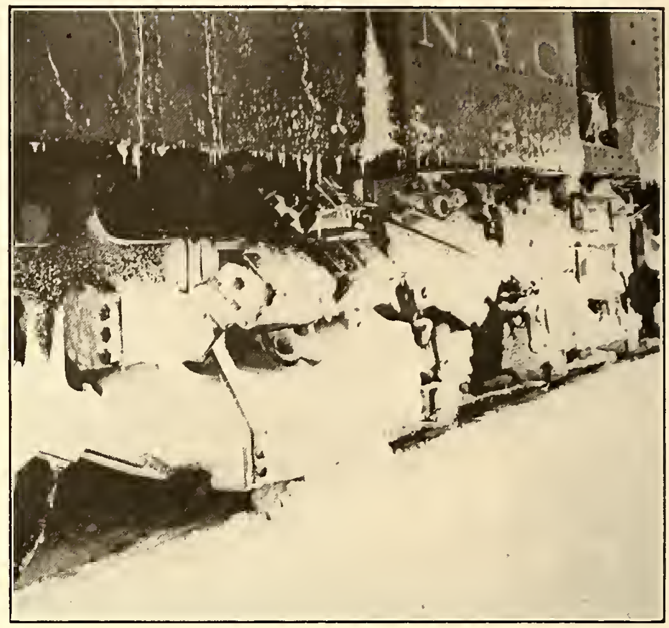
TYPES OF THIRD RAILS USED ON EXPERIMENTAL TRACK, AND EFFECT OF SNOW ON THEM

tected third rail; (2) the protected type of over-running third rail, similar to that used on the New York Subway, and described in the STREET RAILWAY JOURNAL for Oct. 8, 1904, page 632; (3) the under-running type of third rail in which the rail is inverted. This rail was described in the STREET RAILWAY JOURNAL for Sept. 2, 1905, page 336. It was de-

LOCOMOTIVE EQUIPPED WITH PLOW

signed and patented by W. J. Wilgus and F. J. Sprague, and has been developed by E. B. Katte, electrical engineer of the New York Central Railroad Company.

The test was conducted Feb. 9. The locomotive left the car house at 10:30 a. m., and ran all the morning on the section of track east of the sections laid with the protected third rail. At the time the locomotive went on the track, there was 13 ins. of snow between the rails. Both protected and unprotected over-running rails were completely covered, and in some cases there were from 4 to 6 ins. of snow on top of the



CONDITION OF SHOE

protection boards. The electric locomotive carried on its pilot the usual steam railroad type of plow illustrated in the accompanying engraving. It was found, however, that while this style of plow cleans out snow from between the track rails it does not throw it clear of the third rail, so that from the standpoint of third-rail operation much better service on the over-running rail would have been obtained without the plow.

The first third-rail test was made on the over-running unprotected third rail. Very little flashing or trouble was experienced on the first trip of the locomotive. On the following trips conditions grew worse, due to the fact that ice had formed and the snow had become ironed by the shoes. This interfered with collection and contact. It finally became so bad that it was found almost impossible to run the locomotive over the rails.

The next test was made with type 2, or the over-running protected type of third rail. The service of this rail was found to be not much better than that of the bare rail; in fact, in some cases it was worse. The wings of the snow plows would throw up enough snow to keep the top of the rail covered.

At 2 p. m. the locomotive began operation on the long stretch of under-running rail, or type 3. With one exception, there was practically no trouble. This case happened at the west end of the line, where there are two short lengths of this rail installed. The long stretch of open track, equipped with the under-running third rail and which lies between the Fonda, Johnstown & Gloversville station and the West Crossing, gives the shoe a chance to fill up with snow and ice, and it was found that when the top-contact surface of the under-running shoe strikes the rail there is a chance of the circuit being broken. Nevertheless, the test showed that after the locomotive had made one trip over the under-running rail the snow became scooped from under the contact surface for 2½ or 3 ins., and unlike the over-running rail, each passage of the locomotive would tend to clean off the surface of contact. The theory for this action is that the tendency of the shoe is to flatten down the snow which rests on a horizontal surface, as on the over-running type, and to scrape off that which clings to the lower surface of the inverted rail. Moreover, the falling snow will form a pocket under the inverted rail, but will tend to heap up on the old form of rail.

The conclusions reached from this test were: (1) The conditions under which the locomotive was operating were more severe than in regular service, as no flanges were run over line; (2) the snow plow at present on the locomotive can be improved; (3) that the operation of the shoes on the under-contact rail is much more satisfactory than on the other types, and that it is much easier to keep clean.

19,000-KW POWER HOUSE IN WASHINGTON, D. C.

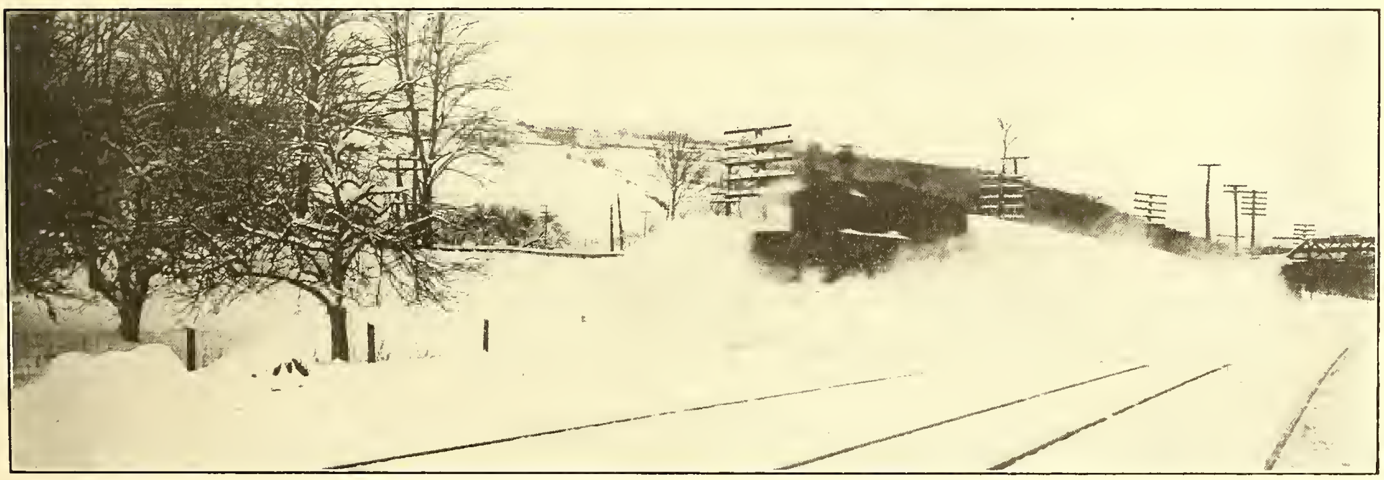
The Potomac Electric Power Company, of Washington, has contracted with J. G. White & Co., of New York, for the erection and equipment of a new power house for both lighting and power purposes in the city of Washington. This company is one of the sub-companies of the Washington Railway & Electric Company, which divides with the Capital Traction Company the electric traction business of the Capital.

The power house in question constitutes an important feature of the general plan for expansion and development adopted by the company sometime ago, and will cost ultimately in the neighborhood of $1,500,000. The building is to be approximately 166 ft. x 183 ft. x 67 ft., and will have a steel frame with curtain walls, which will probably be constructed of moulded concrete blocks. The boiler room will contain four rows of boilers with three chimneys, located between the second and third rows. Thus, there will be two divisions of the firing floor, each serving two rows of boilers. The turbine room will be at right angles to the firing room and will have no basement, its floor lying in approximately the same level as the boiler-room basement.

The first installation will consist of two 2000-kw and one 5000-kw Curtis turbines with boilers and superheaters, and the building is designed for a future installation of two additional 5000-kw Curtis turbines with their steam generators, making a power house of 19,000-kw ultimate capacity. There will be galleries around all the units, connected by short bridges, to permit of easy communication, making, in effect, a secondary operating floor in the turbine room. All of the turbines will generate 25-cycle, three-phase current at 6600 volts for distribution directly to the sub-stations. Two of the 2000-kw units are already installed, one of them being equipped with an ordinary type of surface condenser. All of the remaining units, however, will have the latest type condensers, self-contained in the base of the turbine.

The intake and overflow conduits for the condensing water will run underneath the turbine room, approximately along the center line. There will be a small coal bunker over the firing floor of each boiler, but the main storage room for coal will be outside of the power house back of the boiler room. There will be installed the necessary means for distributing the coal, which will be delivered from railroad cars, in the storage room and of reclaiming it and delivering it to the system of conveyors which will distribute among the bunkers. These ashes will be collected in ash cars running underneath the boilers, and the same apparatus which distributes the coal over the storage area will be used for ashes.

The boilers will be fed by mechanical stokers, supplied directly from the overhead bunkers, and will carry 175 lbs. steam pressure. The superheat will be 150 degs. at that pressure. All of the auxiliary machinery, with the possible exception of the coal-handling apparatus, will be steam driven, and will exhaust into feed-water heaters.



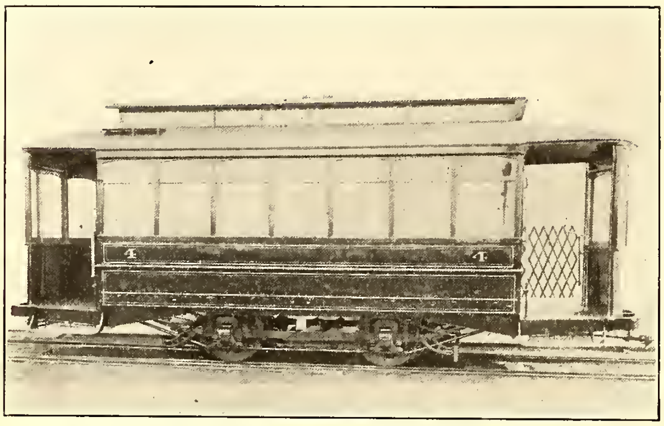
CUTTING THROUGH A DRIFT NEAR SCHENECTADY

The controlling apparatus will be entirely contained in a switch house adjoining the main generating room, and will be distributed among three galleries. The ground floor will contain only the outgoing feeders and main generator leads. The second floor will contain all the bus-bar compartments, disconnecting switches and static apparatus, together with instrument transformers. The third floor will contain both alternating and direct-current switchboards.

A storage battery will be installed, having sufficient capacity to furnish excitation current for the entire station for one hour, so that failure of the exciter units will not cripple the station. The engineering is being done by the contractors.

CARS FOR THE RAILWAY SYSTEM AT ALEXANDRIA, LA.

The Alexandria Electric Railways Company, which is completing its $4\frac{1}{2}$-mile system, including a power house, has recently received four cars from the American Car Company of the type illustrated. Five steam railroads enter the city, and two more are now building, which will be in operation within a year. Red River, on which Alexandria is located, is navigable and flows into the Mississippi, 75 miles to the east. The business portion of the city is paved with asphalt and electrically lighted. The railway stations are some distance from the business center, and the necessity for street lines has been urgently felt. Five large saw mills, three foundries, two cotton oil mills, one sugar mill, several cotton compresses and various smaller industries furnish a livelihood for the population, and there are also four banks. The city occupies a considerable area, and the environs are well populated. A rich, alluvial soil renders agriculture easy and profitable, and the neighborhood is surrounded by vast tracts of valuable timber land. The lines traverse the principal streets and reach an amusement park which is being laid out by the company and is located in the best suburban district. The railway company is backed by Mobile, New Orleans and local capital.



DOUBLE-VESTIBULE SINGLE-TRUCK CAR FOR ALEXANDRIA

INTERIOR OF ALEXANDRIA CAR

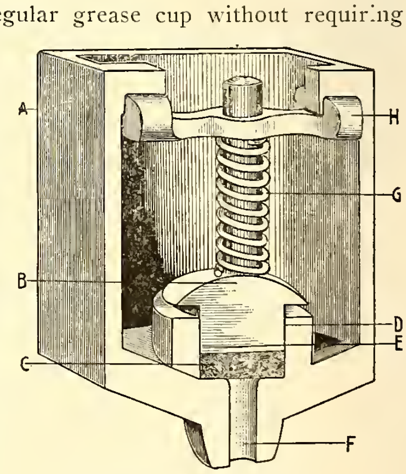
The first rolling stock, which will soon be placed on the lines, consists of four closed cars with 18-ft. bodies and measuring 27 ft. over the dashers. Although somewhat shorter than is usual, these cars have ample width for comfortable transverse seats and a wide aisle. The upper window sashes are stationary, and the lower arranged to drop into pockets in the side walls. Instead of using movable partitions to divide the car into compartments for white and colored people, as is customary in a number of Southern cities, a signboard sliding on rods in the monitor deck, indicates the seats which are for the use of colored people. Brill seats are used, which are upholstered in spring cane, and have corner grab handles. The cushions tilt and are 15 ins. x 34 ins. The interiors are finished in ash, with ceilings of decorated birch. Portable vestibules of the Brill type are used, and the folding gates, brake handles, angle-iron bumpers, "Dedenda" platform gongs, retriever signal bells and other specialties are of the same make.

The general dimensions are as follows: Length over the end panels, 18 ft., and over the dashers, 27 ft.; width over the sills, including the plates, 8 ft. 1 in., and over the posts at the belt, 8 ft. $3\frac{1}{2}$ ins.; sweep of the posts, $1\frac{3}{4}$ ins.; distance between the centers of the posts, 2 ft. $6\frac{1}{4}$ ins.; height from the floor to the ceiling, 8 ft. $5\frac{5}{8}$ ins.; from the under side of the sills over the trolley board, 9 ft. $5\frac{7}{8}$ ins.; from the track to the platform step, 15 ins.; from the step to the platform, $12\frac{1}{2}$ ins., and from the platform to the car floor, $6\frac{3}{8}$ ins. The thickness of the side sills and the end sills is 4 ins. x 7 ins. The corner posts are $3\frac{3}{4}$ ins. thick, and the side posts, $2\frac{3}{4}$ ins. The wheel base of the trucks, which are of the No. 21-E type, is 7 ft.; diameter of the wheels, 33 ins., and the diameter of the axles, 4 ins. Two 25-hp motors are used per car. The weight of a car and truck without the motors is 12,300 lbs., and with the motors, 17,700 lbs.

A PRACTICAL OIL CUP FOR RAILWAY WORK

After an extended experience in electric railway work with various forms of grease and oil lubricating devices for axle and armature bearings, F. P. Maize, of Rochester, N. Y., devised a new form of oil cup which he has recently placed on the market. The construction details of this cup, which is known as the "F-M", are shown in the accompanying illustration.

The cup is a rectangular casting and so designed as to be easily fitted into the regular grease cup without requiring any alteration in the latter. It consists of the shell "A" which holds the oil. In the center of this shell is a piston "B" which rests upon a felt washer "C"; this washer catches the oil which runs down to it through the almost imperceptible spaces "D" and "E"; from the washer "C" it is fed through the outlet "F" directly upon the bearing. Encircling the piston rod, a tight coil spring "G" is placed. At the top of the spring, a bar "H" serves to keep the pressure on the spring against the piston, the motion of the car causing the piston to move up and down slightly, thus squeezing the oil out of the felt washer and allowing it to run onto the bearing.



SECTION OF OIL CUP

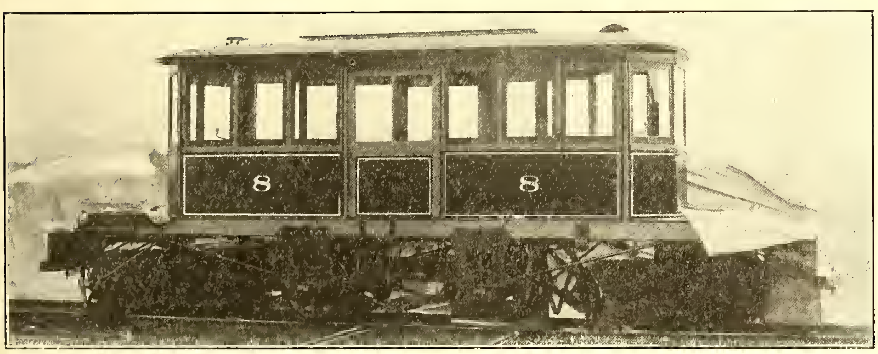
There is no dripping and the inconvenience of adjusting and attaching, so necessary in most oiling devices, is entirely overcome. The entire mechanism of the cup is so simple that there are no parts to get out of order and the feed adjusts itself. The only attention which the oil cup requires is to see that it is filled at regular intervals. The cups are made to fit any size of standard motor.

There has never been a satisfactory oil cup for the older style motors, and but for that reason more companies would now be using oil. The "F-M" Oil Cup has been in daily use on the cars of the Rochester Railway Company for more than eighteen months, and it is now using some 1400 of these cups, and is said to be entirely satisfied with their work. The statement is made that they have cost not a cent for repairs in all this time.

There are no parts to clog up or stick, nor is there any way in which the oil can leak out. There are no loose parts to wear out by rattling and banging themselves to pieces; the greatest space between working parts being not more than 1-100 in. Attention is particularly directed to the fact that all dirt settles in the lowest part of the oil cup, below the point where the oil feeds felt washer, hence the feed never becomes clogged.

SNOW SWEEPERS FOR LEHIGH VALLEY TRACTION COMPANY

The snow sweeper shown in the accompanying cut is one of four delivered a few weeks ago to the Lehigh Valley Traction Company by the J. G. Brill Company. The STREET RAILWAY JOURNAL of Jan. 20 contained a description of twenty cars built by the G. C. Kuhlman Car Company for the Lehigh Valley Traction Company, and included information about the company's 150-mile system in Allentown and vicinity. The valley traversed by the principal division of the system



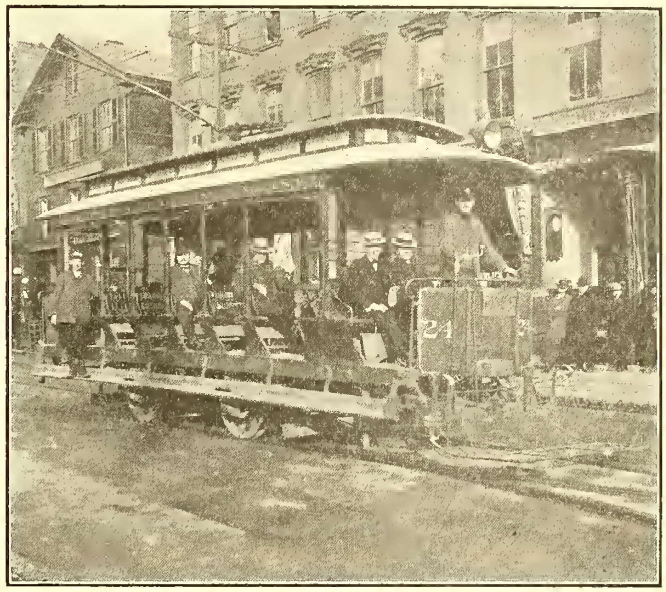
ONE OF THE NEW SWEEPERS FOR FIGHTING SNOW IN THE LEHIGH VALLEY

is subject in winter to snow storms of considerable severity, and the last two seasons made a heavy demand upon the resources of the company for keeping the lines clear. The additional snow-fighting equipment, therefore, has been secured, but up to the present there has been little use for it. This type of sweeper has been frequently described in these pages, and therefore the features of the apparatus need not be repeated.

The cars are larger than usual to permit long brooms to be used. The length over the end sills is 26 ft. 2¼ ins., and over the bumpers, 32 ft. 8¼ ins.; width over the sills, 6 ft. 10¼ ins.; height from the track to the sills, 3 ft. 6 ins.; height from the track to the trolley board, 11 ft. 6 ins.; thickness of the side sills, 4¼ ins. x 8¾ ins., with 8-in. x ½-in. sill plates on the outside. The brooms are arranged to be raised or lowered at each end to suit the curvature of the roadbed. The cars are mounted on gear trucks, having a 7-ft. wheel base and 33-in. wheels; diameter of the axles, 4 ins., and diameter of the broom shafts, 3¾ ins. Two motors are used for propulsion and one for driving the brooms. The weight of a car and truck without the motors is 16,000 lbs.

OPEN CARS FOR WINTER SERVICE IN VERMONT

The very unseasonable weather which was experienced in January proved very satisfactory to street railway operation, and was especially noticeable as it followed the two most



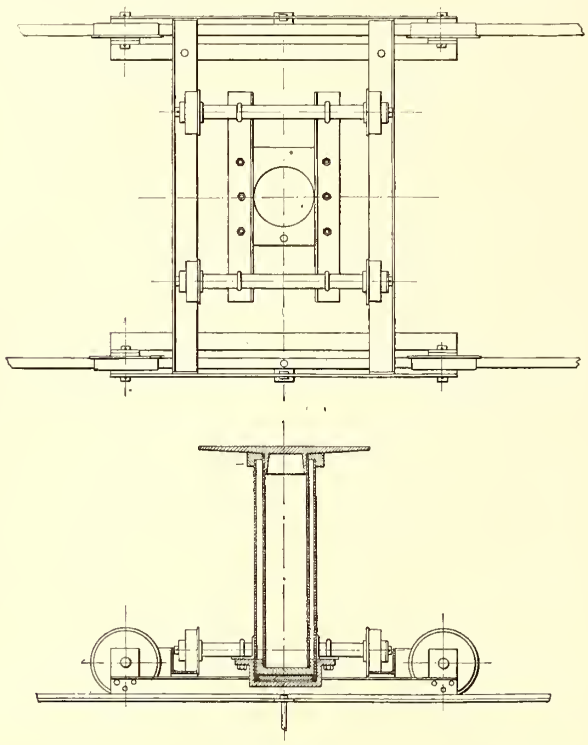
SCENE IN BURLINGTON, VT., DURING JANUARY

severe seasons, as far as snow and low temperature are concerned, which have occurred in the Eastern States since the establishment of the Weather Bureau. The accompanying illustration of an open car in January was not received, as some of our readers might suppose, from Florida, but represents an actual occurrence in the streets of Burlington, Vt., last month. The photograph was taken on Jan. 23, and the car shown was in regular service from 1 p. m. to 5 p. m. on Jan. 22. On those days the temperature was above 60 degs. F. On the same day last year the ice companies in Burlington were cutting ice on Lake Champlain.

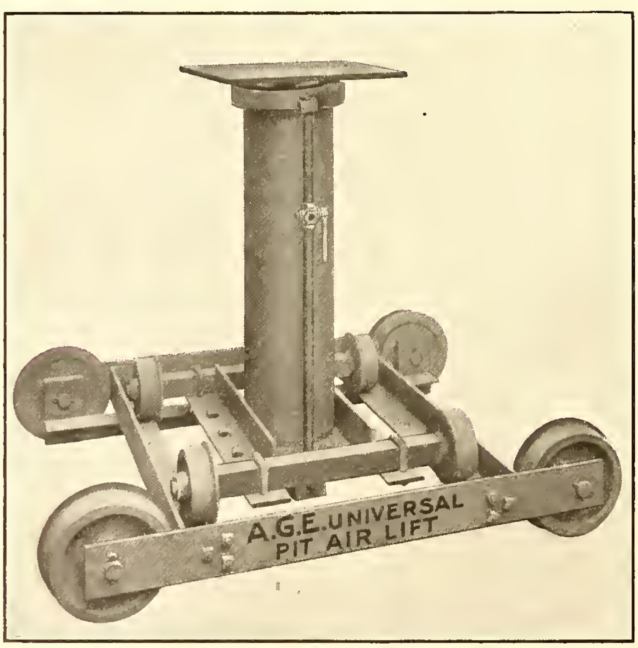
The Allis-Chalmers Club, of Milwaukee, Wis., has issued an attractive little brochure containing its constitution and by-laws, which are very complete and concise. This club was established by the Allis-Chalmers Company for its office men, superintendents and foremen, as a well-appointed club, occupying quarters in a former mansion house near the works, where, for a nominal yearly fee, members are given all the benefits usual to such organizations. During the noon hour a course dinner is served at approximately what the service costs, and supper may also be had by those who are obliged to stay late at the office. The club building stands in a residence district and is easily accessible from all parts of the city.

AIR JACK FOR PIT WORK

The American General Engineering Company, of New York, has recently added to its list of improved railway shop devices a pneumatically operated pit jack. Although of light construction, it is especially adapted for lifting heavy parts under cars, saving time and labor in transferring them, besides insuring safety in operation. The jack is built for standard gage and, as will be noted from the illustration, has a transverse track to reach all parts on either side of the car without moving the jack. It is equipped with a three-way valve, making it simple to operate with a ¾-in. rubber hose so that the different positions of the jack do not affect the air supply. This device is capable of lifting 4000 lbs. under 90 lbs. air pressure.



PLAN AND SECTION OF PNEUMATICALLY OPERATED JACK FOR CAR PITS



AIR LIFT FOR PIT WORK

The standard dimensions of this jack are: from the track to the top of the table, 40 ins.; stroke, 28 ins.; table, 18 ins. square, and travel on the transverse track, 10 ins. The company is prepared, however, to make jacks to suit special conditions and in accordance with the specifications presented by the customer. In one instance the company is building a jack for a large city system in the Central West, requiring a different height and stroke.

Among the railway companies using this device may be mentioned the Public Service Corporation of New Jersey, which has installed over fifty of these air jacks in its new shops.

SINGLE-PHASE RAILWAY MOTORS DISCUSSED BY PACIFIC COAST ENGINEERS

At the February meeting of the Pacific Northwest Society of Engineers, a paper was read by C. Edward Magnusson, assistant professor of electrical engineering in the University of Washington, entitled "Recent Development in Electrical Engineering." The paper dwelt very largely with the advantages afforded by alternating single-phase currents for heavy traffic on surburban lines, and was discussed by Elbert G. Allen, electrical engineer for Seattle Electric Company; H. Day Hanford, formerly superintendent of construction, Indianapolis Interurban Railway Company; Cyrus A. Whipple, electrical engineer at the Puget Sound Navy Yard, Bremerton, Wash., and W. S. Wheeler, inspector of franchises for the city of Seattle.

ELECTRIC COMPETITION CAUSES OHIO STEAM RAILROADS TO REDUCE FARES

The Lake Erie & Western Railway and the Cincinnati, Hamilton & Dayton Railroad (steam) have been stirred into a reduction of rates by the new agreement between Western Ohio traction lines known as the "Lima Route" which, as has been stated in these columns, provides for through limited service between Dayton, Fort Wayne, Toledo and intermediate points, directly paralleling the steam roads mentioned. The two roads have adopted the "twin ticket" scheme, by which round-trip tickets are sold between any competitive points for the single fare plus 10 cents. Tickets are good for a round trip, for two trips in one direction or for two passengers on one trip, amounting practically to a straight cut in rates.

WESTERN OHIO RAILWAY COMPANY'S PUBLICITY METHODS

The Western Ohio Railway Company has installed folder racks in all stations between Dayton and Findlay. In these racks will be found the time cards of all the electric lines in Ohio and Indiana, together with maps and information showing routes and rates. The company has started an intelligent campaign of information showing the possibilities of fast travel by electric lines. The company designates its system and connecting lines as the "Lima Route," and all literature bears a trade-mark showing the through route between Dayton, Fort Wayne and Toledo, with Lima as the central point. The through business being developed by this system is becoming a very important item in its receipts.

FINANCIAL INTELLIGENCE

Wall Street, Feb. 14, 1906.

The Money Market

Contrary to general expectations the money market developed a decidedly harder tendency during the past week, rates for both call and time loan accommodations ruling materially higher than those prevailing at the close of last week. The firmer conditions are due largely to the preparations for financing a number of prospective bond issues by railroads and other corporations, the most important of those contemplated being by the Southern Railway, the American Telegraph & Telephone Company, the Louisville & Nashville, the Pennsylvania and the Atchison, and also a $20,000,000 issue to be sold this week by the City of New York. Other important factors working in favor of a firmer market were the heavy losses in cash sustained by the local banks in their operations with the sub-treasury, and the comparatively light receipts of money from the interior. Shipments of gold to Argentina continue, the amount to be exported to that point this week being $1,750,000. The demand for funds throughout the week has been fairly active, but in view of the demands above noted, the banks and other lenders are not disposed to offer with any degree of freedom except at the higher quotations, the opinion being quite general in banking circles that the market will rule firm until the usual spring demand for money at the interior has been satisfied. Foreign exchange has ruled decidedly easier, thus eliminating the possibility of gold exports to Paris, at least for the present. A feature of the week has been the disposition of foreign bankers to take advantage of the higher rates prevailing for time loans. Not only have a number of maturing loans been renewed which otherwise could have been called, but fair amounts of fresh money has been made available for market purposes. Government finances continued to improve, and indications point to the restoration of the surplus in the near future. The European markets have ruled easier, especially at Paris, where money has been plentiful and cheap. The statement of the clearing house banks, published last Saturday, was very disappointing. Loans increased $4,632,100, and deposits decreased $452,200. The loss in cash was $5,297,100, and was considerably larger than expected. The reserve required was $113,050 less than in the previous week, which, deducted from the loss in cash, shows a decrease in the surplus reserve of $5,184,050. The surplus is now $5,943,575, as against $11,036,925 in the corresponding week of 1905, $20,379,225 in 1904, $15,529,675 in 1903, $13,560,850 in 1902, $12,852,450 in 1901, and $35,511,825 in 1900.

Money on call has been in good supply at rates ranging from 3¾ to 5 per cent, the average rate for the week being about 4¼ per cent. Time money was fairly active at 5 per cent for all maturities up to six months, being an advance of ½ per cent. Mercantile paper is quoted at 4¾ and 5 per cent for the best names, and 5 and 5½ per cent for other good names.

The Stock Market

The past week in the stock market has been one of comparative inactivity, with price changes as a rule over a rather narrow range, and with very few developments of account and important nature. One of the reasons for this condition of affairs was the occurrence of the Lincoln's birthday holiday, but there were several other more potent factors which operated toward bringing about the conditions noted. Among these may be specifically mentioned the continued active agitation of railway rate legislation in Congress, the uncertainties felt regarding the possibility of a coal strike, though toward the end of the week the general sentiment was that there would be no strike; a firmer tendency to the market for time money and the manifestation of some fears about the future working of the call loan market, more particularly in view of the several impending large bond issues, and a weaker tone in the iron, steel and copper metal markets. With this array of unsettling elements was a rather pessimistic feeling on the part of professional stock market operators, who were more inclined to sell on the strong spots than to buy on the declines. Moreover, there was a very natural disposition on the part of recent purchasers of stocks to turn profits into cash, and in consequence prices at intervals were inclined to sag. However, no such slump in values as that which has lately been predicted so generally occurred, but on the contrary frequent and substantial rallies took place, and at the close of the week prices in not a few instances were somewhat higher than at the end of the previous one, while in a few cases new high record figures were touched. The most notable features of strength were the so-called Hill stocks, which were benefited by the reports current relative to the proposed Great Northern ore land deal, although the street was convinced that there was something more in the wind to account for the bouyancy of these shares, and clung steadfastly to the belief that there is to be some sort of a "melon cutting." The shares of the copper producing companies were likewise decidedly strong, explanation for which was afforded by the confirmation of the reports previously current of a final and amicable settlement of the long-existing difficulties between the Heinze and Amalgamated copper interests. The coal stocks reflected the belief that there will be no strike of the miners next April, and this in turn had a good influence upon the market in general. While sentiment was undoubtedly more optimistic in the closing day of the week, indications pointed to a continued comparatively narrow market with uncertain movements in prices, at least until such time as the monetary outlook becomes clearer.

In common with all other stocks, those of the local traction companies developed considerable irregularity during the greater portion of the week, but towards the close they all moved up, though there was not very much in the way of activity. The late improvement was partly in sympathy with the recovery in the general list, but a favorable decision from Albany, upholding the lease of the Metropolitan Street Railway to the Interurban Street Railway Company, and the publication of an excellent statement of earnings by the Interborough Company for the quarter and the half year ended Dec. 31, contributed not a little to the stronger tone of this entire group.

Philadelphia

Trading in the local traction issues has been considerably less animated during the past week, but values generally displayed decided firmness. Philadelphia Company common was firmly held at 53⅛ and 53, about 4000 shares changing hands at those prices, while small amounts of the preferred brought 50¾ and 51. Philadelphia Rapid Transit was well supported, upward of 1000 shares changing hands at 33 and 32⅝. Consolidated Traction of New Jersey was in better demand, 500 shares selling at 81⅞ and 82. Philadelphia Traction was quiet but strong, with transactions at 101 and 101¼. Union Traction ruled unchanged at 63½. Other transactions included Railways General at 7 1-16 and 7, American Railways at 53 and 52¾, United Companies of New Jersey at 269¼, and Union Traction of Pittsburg preferred at 51.

Baltimore

Increased activity and pronounced strength has characterized the market for traction issues at Baltimore. United Railway shares furnished the overshadowing features, prices for both stocks and bonds reaching the highest points attained for a long while. Interest centered in the incomes, which were heavily bought, on reports that the much-talked-of deal was about to be consummated. The free incomes rose from 72½ to 74⅝, and closed at 74½, while the pooled bonds advanced from 71 to 73, and closed at the highest. About $725,000 of both issues were dealt in. The stock also developed considerable activity, about 8000 shares of the free stock changing hands at from 17⅛ to 18½, while nearly 10,000 shares of the deposited stock brought prices ranging from 18½ to 19¼. The 4 per cents were comparatively quiet, $60,000 selling at 94 and 94¼. Charleston Consolidated Electric 5s rose from 97¼ to 98½, on the purchase of $19,000, and Norfolk Railway & Light 5s brought 100⅛ and 100½ for $17,000 bonds. Other sales included $5,000 Knoxville Traction 5s at 108½, $3,000 Macon Railway & Light 5s at 100, and Baltimore City Passenger 5s at 105½.

Other Traction Securities

Generally lower prices accompanied the dealings in street railway stocks at Chicago. Chicago City Railway sold to the extent of 200 shares at 195 and 194½, and 100 Chicago Union Traction brought 11¾. South Side Elevated ran off to 94½, on the exchange of odd lots. Chicago & Oak Park common sold at 6¾, and the preferred sold at 26½. Metropolitan Elevated common brought 27, and the preferred 69¾. The Boston market has been active and irregular. Boston & Suburban common, after selling at 27, broke to 25, and subsequently rallied to 26½, while the preferred stock declined from 72 to 68½, with a late rally to 70. Boston & Worcester common sold from 30½ to 32, and then rose to 35, and ended the week at 34, while the preferred declined from 84½ to 80, and then advanced to 85¾. Toward the close the price ran off to 82⅝. Massachusetts Electrics were strong, the common advancing to 19 and the preferred to 68 on comparatively light transactions. Other transactions included Boston Elevated at from 155 to 156, and back to 155, West End common at 99½ and 99, and the preferred at 114½ and 114. In the New York curb market trading has been fairly brisk, at slightly lower prices. From 234 at the beginning of the week, Interborough Rapid Transit declined to 232⅞, on the exchange of 2400 shares. Interborough Metropolitan common dropped from 56 to 54, on the exchange of about 7500 shares, while 700 shares of the preferred changed hands at from 96 to 95. The new 4½ per cent bonds sold to the extent of about $400,000, at 93¼ and 93½. New Orleans Railway common sold at 37½, and the preferred at 84. New York, West Chester & Boston certificates advanced from 91¾ to 92⅛, on the purchase of $133,000.

Security Quotations

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

	Feb. 7	Feb. 14
American Railways	53	53¼
Boston Elevated	*156	155
Brooklyn Rapid Transit	86	85
Chicago City	199	190
Chicago Union Traction (common)	11¾	11½
Chicago Union Traction (preferred)	—	42
Cleveland Electric	82	82
Consolidated Traction of New Jersey	81	81
Detroit United	101	101
Interborough Rapid Transit	233	232
Interborough-Metropolitan Co. (common), W. I.	55⅛	53¾
Interborough-Metropolitan Co. (preferred), W. I.	95½	94½
Interborough-Metropolitan Co. 4½s, W. I.	93	93⅜
International Traction (common)	36½	38
International Traction (preferred), 4s	—	75
Manhattan Railway	160½	160½
Massachusetts Electric Cos. (common)	18½	19
Massachusetts Electric Cos. (preferred)	68	68½
Metropolitan Elevated, Chicago (common)	27½	26
Metropolitan Elevated, Chicago (preferred)	69¾	69½
Metropolitan Street	121¾	120¾
Metropolitan Securities	71½	71
New Orleans Railways (common)	37	38
New Orleans Railways (preferred)	83	83
New Orleans Railways, 4½s	91¼	—
North American	101¾	102¾
North Jersey Street Railway	25	—
Philadelphia Company (common)	54	52¾
Philadelphia Rapid Transit	32¾	32⅝
Philadelphia Traction	101	101
Public Service Corporation 5 per cent notes	95	—
Public Service Corporation certificates	69	—
South Side Elevated (Chicago)	96	94
Third Avenue	136	135
Twin City, Minneapolis (common)	116⅛	118
Union Traction (Philadelphia)	63¼	63
West End (common)	99	99
West End (preferred)	113½	113½

* Ex-dividend. W. I., when issued.

Iron and Steel

According to the "Iron Age," the production of pig iron during January exceeded all previous records, amounting to 2,068,893 gross tons, exclusive of charcoal pig iron. This is an increase of 23,175 tons over the previous high record established in October, 1905. The situation in plates, sheets, wire products and pipe is unusual.

ANNUAL REPORT OF THE DETROIT UNITED RAILWAY

The annual report of the Detroit United Railway Company for the fiscal year ended Dec. 31, 1905, was presented in detail at a meeting of the stockholders of the company, held on Feb. 6, at Detroit. President Hutchins presented figures showing an expenditure to the property for improvements of more than $1,000,000, and detailed the several betterments. The most important items of this account were $236,809 for permanent foundations under the tracks at Woodward and Monroe Avenues, standardizing 3850 ft. of double track in Fairview, and 10,918 ft. on River Road, and building 1.6 miles of additional side and yard tracks; $111,259 for additional feed wire, poles, cable, etc.; $241,600 for fifty double truck and twelve single truck closed cars, including equipments; $21,428 for a locomotive, automobile truck, twelve flat construction cars and a new line wagon; $46,407 for the completion of the air brake equipment; $204,260 for additions to the power house, in which were installed one Reynolds gearless engine, one engine-type 1500-kw generator, four 350-hp boilers, one booster set and the installation of a complete storage battery at Cortland and Woodward Avenues; $63,753 for real estate; $33,234 for the completion of the St. Jean car house; $20,408 for building 2 miles of main and side track and special work in connection with the State Agricultural Grounds. In addition to the above there has been expended on the Rapid Railway System and on the Sandwich, Windsor & Amherstburg Railway $82,123 for addition to the power house at New Baltimore, the building of a few miles of main track and the installation of additional feeder trolley wire, new paving, etc.

The following is a summary of the business of the Detroit United Railway, the Rapid Railway System and the Sandwich, Windsor & Amherstburg Railway for the years ending Dec. 31, 1904 and 1905:

	1904	1905
Gross earnings	$4,541,805	$5,125,563
Operating expenses, including taxes	2,763,092	3,041,522
Net earnings from operation	$1,778,712	$2,084,040
Income from other sources	42,777	44,076
Gross income less operating expenses	$1,821,490	$2,128,116
Deductions:		
Interest on funded and floating debt:		
Detroit United Railway	$927,371	$960,372
Rapid Railway system	135,050	135,050
Sandwich, Windsor & Amherstburg Railway	13,365	17,871
	$1,075,786	$1,113,293
Dividend, Detroit United Railway	$500,000	$562,500
Total deductions	1,575,786	1,675,793
Surplus income	$245,703	$452 322

Passenger Statistics:	D. U. Ry.	R. R. Sys.	S. W. & A.	Total
Revenue passengers	92,838,540	4,382,142	1,916,876	99,137,558
Transfer passengers	27,593,325	278,694	148,926	28,020 945
Employee passengers	4,193,445	229,099	26,361	4,448,905
Total passengers	124,625,310	4,889,935	2,092,163	131,607,408
Receipts per revenue passr.	.0465	.1043	.0547	.0492
Receipts per passenger	0347	.0935	.0501	.0371

Mileage Statistics:	D. U. Ry.	R. R. Sys.	S. W. & A.	Total
Car mileage	20,697,935	2,260,572	529,778	23,488,285
Earnings per car-mile	.2161	.2408	.2030	.2182
Expenses per car-mile	.1268	.1579	.1107	.1295
Net earnings per car-mile	.0893	.0829	.0923	.0887

The following is a balance sheet of the Detroit United Railway of date Dec. 31, 1905:

LIABILITIES		
Capital stock	......	$12,500,000
Mortgage bonds	......	20,387,000
Current liabilities	......	1,231,812
Unredeemed tickets	......	29,777
Insurance fund	......	25,661
Surplus	......	1,397,636
ASSETS		
Investment	$32,815,879	......
Current assets	2,342,436	......
Prepaid taxes, etc.	80,043	......
Accident fund	19,456	......
Stores	217,793	......
Cash	96,278	......
	$35,571,887	$35,571,887

B. R. T. IMPROVEMENTS OUTLINED

President Edwin W. Winter, of the Brooklyn Rapid Transit Company, says the company has expended almost $20,000,000 for betterments since he took office on July 1, 1902, about three and a half years ago. Mr. Winter has also shown that work now under way will cost over $12,000,000 more. The record covers the period between July 1, 1902, and Jan. 26, 1906. There was expended, during this time, for additions and improvements alone, slightly more than $19,835,000. Of the sum thus expended, $8,653,000 has gone for car equipment alone. There are now under way, authorized and uncompleted, additions and improvements aggregating approximately $12,025,000. A few of the more important items making up this last amount are distributed as follows:

New elevated shops and station at Thirty-Sixth Street	$250,000
Elevating and depressing tracks, Brighton Beach line	600,000
Automatic signals on elevated roads	55,000
Elevated shops and storage yards at East New York	175,000
Car storage depot and shops at Ninth Avenue and Twentieth Street	385,000
Storage yard, shops and changes at Ridgewood "L" terminal	185,000
Canarsie Railroad—reconstruction	670,000
Track reconstruction—elevated and surface lines	1,400,000
Williamsburg power station (which, when completed, will have normal capacity of 116,000 hp)	5,000,000
Completion of fifteen sub-stations	765,000
Completion of subways and feeder system	600,000
Elevated and surface car equipment, contracted for and under way	1,470,000

The following sub-stations have been constructed and placed in operation at a total expense of $1,000,000: Parkville, Halsey Street, Essex Street, Tompkins Avenue, Southern Bridge, Coney Island and Mrytle Avenue. The following sub-stations are now under construction, at an additional cost of $566,000: New Utrecht, Hudson Avenue, Richmond Hill, Prospect Park, Corona, Canarsie and Lexington Avenue.

In addition the company has made a statement to the Brooklyn League, covering the improvements from July 1, 1902, to June 30, 1905. This contains among its items detailed reference to the extension of surface tracks, track improvements, storage yards and terminal facilities. Then under miscellaneous there are detailed these items:

Pavement, approximately 27,500 yds., or 35 miles, double track; electrically welded joints, approximately 20,000 joints; tunnel arch over South Brooklyn railway tracks, from Fourth Avenue to near Seventh Avenue, 1200 ft.; club house, East New York; Thirty-Ninth Street car repair shops, constructed from old terminal buildings; office building, ten-story, completed; dock facilities, improved by extension at Fifty-Second Street, Sixty-Fifth Street, Newtown Creek and coal storage; also handling facilities at Newtown dock; Brighton Beach grade crossing work, completed at Park Place and Prospect Place, commenced work on Section No. 2; High Street emergency station; school room for employees at Fifty-Eighth Street depot.

New car equipment, surface lines—201 convertible cars, 3700 series; 100 combination cars, 100 open cars for summer.

New car equipment, elevated lines—120 open cars for summer, with side panels for winter operation; 100 closed motor cars, 100 convertible motor cars (above including electrical apparatus, brakes, trucks, etc., to complete equipment of cars).

Elevated cars rebuilt and converted to modern electrical standard—123 steam coaches rebuilt for motor cars, including addition of necessary motors, trucks, brakes and electrical apparatus; 182 motor cars rebuilt; 230 trail cars rebuilt; 73 motor cars, rebuilding now in progress; 40 trail cars.

Miscellaneous equipment—70 gondola cars for construction and maintenance; new central power station constructed; Eastern power stations; new Williamsburg power station; sub-stations completed, Halsey Street and Broadway, Fulton and Essex Streets, Tompkins Avenue and Fulton Street, Myrtle Avenue and Broadway, Sands Street and High Street, Brighton Beach line at Long Island Railroad, Coney Island at Culver terminal; under construction, Fifty-Second Street and First Avenue, New Utrecht Avenue, Hudson Avenue, Richmond Hills, Canarsie.

New shops—East New York, Thirty-Ninth Street.

Interlocking signal plants at fourteen points; painting structure, 50,000 ft., practically completed; platforms, lengthened for six-car trains on Fulton Street, Lexington Avenue, Fifth Avenue, Broadway.

FIRE AT POUGHKEEPSIE

Shortly before 1 a. m. on Sunday, Feb. 11, fire was discovered in the power house of the Poughkeepsie & Wappingers Falls Railway Company, on Main Street, Poughkeepsie, N. Y., and before the flames were extinguished the plant was almost entirely destroyed, thus cutting off street railway service and necessitating the suspension of the lighting service temporarily.

The origin of the fire is unknown. Everything was destroyed except the boilers and one car, which had not reached the car house. The boiler room, however, was untouched, as there was a brick fire-wall between the engine room and the boiler room. The engines and generators are wrecks, as the roof fell in on them. Twenty-three cars and a new snow-plow also were destroyed. They fell into the cellar and the roof fell on them. The iron parts are, of course, all warped by the heat. The plant consisted of a car house at street level, with room for twenty-four small cars, an office and a waiting room in front. As the ground falls off in the rear, below the car house was a repair shop quite well equipped for a small road. Here also was the power station, which contained a pair of the early General Electric multipolar, direct-connected generators, driven by Ball cross-compound high-speed engines, of about 300 hp each, which were run condensing. A high-speed Watertown simple engine was direct connected to a 100-kw, 110-125-volt d. c. Walker generator, for commercial lighting in the city. The three 300-hp Stirling boilers are unharmed. The loss is unofficially placed at $200,000, covered in part by insurance.

INTERURBANS OUT OF JOLIET

Included in the plans of the Joliet & Southern Traction Company for building a system of electric railways, to radiate from Joliet as a center, is an interurban terminal station, to be located at Joliet. The company is now before the Joliet City Council, asking for a franchise granting independent entrance to the center of the city from all directions, which embraces about 6 miles of tracks on prominent unoccupied streets. The new interurban station will be patterned after the one at Indianapolis, with about eight parallel tracks and a six or eight-story office building, occupying half a block. There will be no grade crossing with steam railroads within the limits of the city, and the construction throughout will be strictly first class in every respect. The line between Joliet and Dwight will be practically the last or connecting link in an electric line between Chicago and St. Louis. Active work all along the line will be commenced as soon as the weather will permit in the spring, and pushed to completion as rapidly as possible. The Joliet, Plainfield & Aurora Railroad, which has been in operation nearly two years, is owned by those promoting the new companies, and may become a part of the combined system. In any event, it will be operated in harmony with the Joliet & Southern. The overhead trolley system will be used, with the possible exception of the line between Joliet and Blue Island. This division will be built to shorten the time, in connection with the Illinois Central, between Joliet and Chicago, and will probably be equipped with third-rail and high-speed equipment, with the expectation of making the run from Joliet to Chicago in 1 hour or less.

THE EAST ST. LOUIS CONSOLIDATION

Announcement is expected in a few days of the consolidation of the East St. Louis & Suburban Railway with the Alton, Granite & St. Louis Traction Company. Plans for the merger have been under consideration for some time, and the preliminary meeting will probably be held in a day or two. The companies in the proposed deal own 117 miles of track in and between East Side cities and the electric light plants and gas works in East St. Louis and Alton. D. R. Francis & Bro. represent the stockholders in the Alton & Granite City Company, and E. W. Clark & Company, of Philadelphia, control the East St. Louis & Suburban. C. M. Clark is president of the latter company, and has taken active part in the negotiations. It is expected that the basis of consolidation will give Alton & Granite stockholders share for share in the holding company, and East St. Louis & Suburban stockholders two shares in the holding company for one of the original stock. This is based on the present market values of the stocks, which are about $75 and $150 respectively.

FEBRUARY MEETING OF THE AMERICAN STREET RAILWAY MANUFACTURERS' ASSOCIATION

A meeting of the American Street Railway Manufacturers' Association was held on Feb. 9, 1906, at 26 Broadway, New York City. There were present Messrs. Baker, Ellicott, Garland, Huelings, Knickerbocker, Martin, McGraw, Nute, Pierce, Randall, Wharton and Williams. B. V. Swenson, secretary of the American Street & Interurban Railway Association, was also present by invitation. Owing to the fact that Mr. Baker, the chairman of the meeting, is also chairman of the finance committee, and had to present his annual report, James H. McGraw was made acting chairman. Mr. Baker then read the finance committee's report, covering the receipts and expenses for the 1905 convention. He gave the total receipts, including a slight balance from 1904, as $12,616.71; total expenditures, $12,266.45; leaving a balance of $350.26. On motion of Mr. Peirce, seconded by Mr. Williams, Mr. Baker's report was unanimously approved and accepted. Mr. McGraw stated that he and Mr. Baker, by invitation, attended a meeting of the executive committee of the American Street & Interurban Railway Association, in New York, on Feb. 6, at which it was suggested that a committee of three of the American Street Railway Manufacturers' Association's committee be appointed to act with another committee of three appointed by the American Street & Interurban Railway Association, to decide on a meeting place for the next annual convention. On motion of Mr. Nute, seconded by Mr. Huelings, and carried, Messrs. Knickerbocker, McGraw and Peirce were appointed a committee with power to act. Upon the motion of Mr. Peirce, seconded by Mr. Wharton, a committee of five, with three constituting a quorum, was appointed to draft a new constitution and by-laws, to be laid before the executive committee for approval. Messrs. Baker, Ellicott, Martin, McGraw and Peirce were appointed as members of this committee. An executive committee meeting is to be called for April 26, to consider the proposed new organization, and a members' meeting for April 27. A motion, made by Mr. Ellicott and seconded by Mr. Williams, was approved by those present to the effect that the secretary forward at once to each member of the executive committee a copy of the present constitution and by-laws, and also to forward a copy of the new draft to each member of the present committee as soon as practicable.

IMPROVEMENTS ON THE CLEVELAND & SOUTHWESTERN

The Cleveland & Southwestern Traction Company is spending a large amount of money in improvements this year. Contracts were closed last week for fifteen new cars, all of which will be built by the Niles Car & Manufacturing Company, the deal being effected through Charles F. Johnson, who will take some of the old cars of the company. Eight of these cars will be delivered within six weeks. They will be practically duplicates of the cars delivered to this company a short time ago, which were illustrated in this paper. They will be 51 ft. long, will have baggage, smoker and passenger compartments, with high roll seats in the passenger compartment and green leather in the smoking compartments; four of them will have carpeted floors and chair seats in the smoker, and will be used for limited service. The other seven cars on order will be delivered May 15. They will be 46 ft. long, duplicates of the other cars, except that they will not have the baggage compartments. This will give the company 30 new cars this year. Seventeen old cars will be disposed of, giving the company fifty-five cars, none of them more than three years old.

The track between Cleveland and Elyria is being rebuilt, and part of it will be put on private right of way. The running time between Cleveland and Elyria, heretofore the slow part of the road, will be greatly reduced. An additional 750-hp boiler will be contracted for in the near future for the Elyria power station, and a dam will be built in the river near the station to provide additional water supply and a cooling pond for condensing water.

C. N. Wilcoxson, general superintendent of the company, is preparing plans for a new repair shop and car house, which will be of the most approved character for handling all the rolling stock, and it is probable that this will be built this year. Since the installation of limited trains and new rolling stock the business on this system has shown remarkable gains, averaging about $12,000 per month growth for the past three months.

INTERBOROUGH EARNINGS

Interesting results are shown in the reports of the Interborough Rapid Transit Company, operating the elevated and the subway lines in New York, for the three months and the twelve months. The increase in surplus for the three months, for instance, shows as $523,711. For the year the surplus was $2,504,140. The reports follow in detail:

	Oct. 1 to Dec. 31, 1905	Oct. 1 to Dec. 31, 1904	Year Ended Dec. 31, 1905
Gross receipts	$5,181,602	$4,472,855	$18,218,264
Operating expenses	2,137,354	1,888,086	8,245,005
Net earnings	$3,044,248	$2,584,769	$9,973,259
Other income	225,792	96,013	701,661
Total income	$3,270,040	$2,680,782	$10,674,920
Fixed charges	2,306,759	2,241,212	8,170,780
Surplus	$963,281	$439,570	$2,504,140

The income account of the subway division of Interborough for the quarter ended Dec. 31, 1905, compares with the two months and four days (Oct. 27 to Dec. 31) in 1904 as follows:

	*1905	†1904
Gross receipts	$1,887,317	$812,090
Operating expenses	744,977	459,254
Net earnings	$1,142,340	$352,836
Other income	111,075	14,513
Total income	$1,253,415	$367,349
Fixed charges	449,736	175,155
Surplus	$803,679	$192,194

* Oct. 1 to Dec. 31. † Oct. 27 to Dec. 31.

For the calendar year ended Dec. 31, 1905 (Jan. 1 to Dec. 31, 1905) the subway's earnings and expenses were:

Gross receipts	$5,815,924
Operating expenses	2,788,773
Net earnings	$3,027,151
Other income	366,591
Total income	$3,393,742
Fixed charges	1,224,170
Surplus	$2,169,572

Manhattan's income account for the quarter and six months ended Dec. 31, 1905, compares as follows:

	1905	1904
Three months (Oct. 1 to Dec. 31):		
Gross receipts	$3,294,284	$3,660,764
Operating expenses	1,392,377	1,428,833
Net earnings	$1,901,907	$2,231,931
Other income	114,717	81,500
Total income	$2,016,624	$2,313,431
Charges, etc.	1,857,022	2,066,057
Surplus	$159,602	$247,374
Six months (July 1 to Dec. 31):		
Gross receipts	$6,097,760	$6,893,713
Operating expenses	2,707,222	2,797,927
Net earnings	$3,390,538	$4,095,786
Other income	186,017	160,500
Total income	$3,576,555	$4,256,286
Fixed charges	3,543,694	3,597,601
Surplus	$41,861	$658,685

INDIANAPOLIS HEADQUARTERS FOR CENTRAL ELECTRIC RAILWAY ASSOCIATION

The permanent headquarters of the Central Electric Railway Association will be established in the Traction Terminal Building, Indianapolis, March 1. John H. Merrill, secretary of the association, will remove from Lima, Ohio, to Indianapolis to take charge, and will establish a bureau of interchangeable mileage in connection with his other duties. Among those present at the meeting held in Indianapolis last week, which resulted in the selection of Indianapolis for the headquarters, were: E. C. Spring president; C. L. Henry and F. D. Carpenter, vice-presidents; E. C. Nichols, Will Irwin, C. C. Reynolds, Gardner Wells, H. P. Clegg, C. N. Wilcoxson, F. J. Sloat and J. H. Brown, of the executive committee. The first meeting of the new amalgamated association will be held in Indianapolis March 22.

GRAND RAPIDS ELECTRIC RAILWAY SECURES CENTRAL MICHIGAN COMPANY

The Central Michigan Railroad Company, it is reported, has been merged by sale into the Grand Rapids Electric Railway Company, which owns right of way for a line of railway from Grand Haven to Grand Rapids, thence northeasterly through Belding, Greenville, Langston, Edmore, Winn, Mt. Pleasant, Rosebush, Clare, Gladwin, West Branch and other towns to Alpena.

The purchase from the Central Michigan Railroad Company also includes a line of railroad right of way southeasterly from this city to Battle Creek, thence to Coldwater and Camden in Michigan, and to Pioneer, West Unity, Archibald, Napoleon, McClure, Weston and Fostoria, in Ohio. All surveys and location of the railroad have been made and right of way secured for 300 miles, 175 miles of which are graded and substantially ready for cross-ties and rails.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED FEB. 6, 1906

811,535. Means for Muting Vibrations in Railway Rails; John Anderson, Boston, Mass. Non-metallic blocks clamped to the web of the rail or opposite side thereof and spaced apart.

811,746. Roadbed; George Ross and Stephen F. Deal, Kansas City, Mo. App. filed June 9, 1905. Consists of a mixture of earth and crude petroleum, asphaltum and crude carbolic acid.

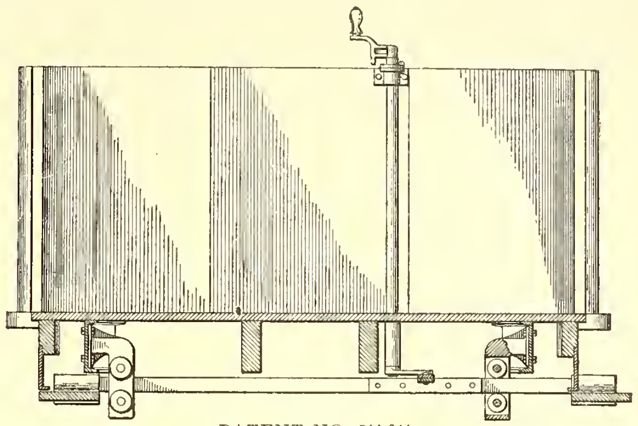
811,765. Air-Brake System and Automatic Valve; Fred. B. Corey, Schenectady, N. Y. App. filed Sept. 16, 1904. Provides an independent source of compressed air on each car, a control pipe extending through the train, and a automatic valve on each car, responsive to variations in the pressures both in the control pipe and in the brake cylinder, and adapted to connect the brake cylinder to the source of pressure or to atmosphere.

811,766. System of Motor Control; Fred. B. Corey, Schenectady, N. Y. App. filed Oct. 1, 1904. Utilizes for each car a single controller of the type which when rotated in one direction controls the motor connections for forward movement, and when rotated in the opposite direction controls the connections for running in the reverse direction, and associating therewith duplicate operating devices, either of which will place the controller in full series position, where it remains until the actuation of the other device, which will then continue the rotation of the controller to its parallel position.

811,822. Automatic Circuit Breaking Safety Appliance for Use in Trolley Wire systems for Electric Traction; James Carter, Stalybridge; George Hall, Manchester, and Arthur Parsons, Leeds, England. The engaging ears of the trolley hanger are hinged so that in case the wire is broken the hinge becomes effective to break the circuit.

811,855. Railroad; George A. Le Fevre, Orangeburg, N. Y. App. filed March 11, 1905. A rail having the usual or any preferred form of tread and having a deep web without a flange, which seats itself in a suitable seat in the sleeper. The seat of the sleeper and a portion of the web of the rail are embedded in the roadbed in such a way that it is impossible for the rails to spread.

811,863. Air Brake; Ernest H. Miller and Charles V. Rote, Lancaster, Pa. App. filed July 21, 1904. A rail brake-shoe and wheel brake-shoes, and a lever adapted to apply the wheel brake-shoes and simultaneously depress the rail brake-shoe, in combination with means acting on said lever to compensate for wear by imparting an accelerated movement to the rail brake-shoe in proportion to the increased distance it has to travel as it wears away.



PATENT NO. 811,911

811,911. Car Step; Delbert A. Faut, Chicago, Ill. App. filed Feb. 11, 1905. The two opposite steps in a closed car are mounted on a common frame which may readily be shifted transversely of the car, so that one operation serves simultaneously to project one step and sheathe or retract the other.

811,919. Trolley Replacer; Robert B. Higgins, St. Louis, Mo. App. filed Aug. 14, 1905. An inverted triangular-shaped trough mounted adjacent the guy wires, whereby the wheel may be guided back to the wire in case it leaves the same.

811,967. Electric Car; Lewis B. Stillwell, Lakewood, N. J. App. filed July 29, 1904. In order to cool the motors, resistances, etc., of a train, and at the same time warm the cars in winter; an air circulatory system is provided through the various resistances and motor casings and leading through the train.

812,018. Method of and Means for Railway Track Construction; Edward E. Clement, Washington, D. C. A method of laying surface-contact railway track, consisting in first arranging supporting means to carry rails during construction approximately at their final level, supporting the rails and contacts with the latter and securing devices supported upon the rails, and building final supporting means under and about the rails and contacts.

812,022. Car Fender and Brake; Lee A. Devin, San Francisco, Cal., and Frank S. Atkins, Oakland, Can. App. filed Nov. 6, 1905. A combined car fender and emergency brake, comprising a frame having a fender-supporting extensions and rearwardly extending track-shoes and a lever to raise and lower the frame.

812,077. Switch-Locking Device; Henry H. Nichols, Philadelphia, Pa. App. filed Nov. 11, 1905. Details of a lock for street railway switches.

812,097. Tramcar and Other Like Vehicle; Ethelbert A. Stanley and John E. Anger, Preston, England. App. filed Feb. 6, 1905. Details of construction of a tramcar.

812,164. Contact Box for Electric Railway Systems; George L. Campbell, Williamsport, Pa. App. filed Dec. 30, 1904. The contact box has a pair of soft iron rods projecting therein which complete a magnetic circuit from an electro-magnet on the car. The circuit is effective to raise a hemispherical iron shell which energizes a contact plate.

REPORT OF CHANGE IN CONTROL OF P. S. C.

It is unofficially stated that an agreement has been entered into by which the Pennsylvania Railroad and J. P. Morgan & Company, acting for clients, will be admitted equally to control with the United Gas Improvement Company, of Philadelphia, the Public Service Corporation of New Jersey, controlling all the electric railway lines in Northern New Jersey and lighting plants throughout the entire State. This will bring together interests somewhat at variance, and will probably result in important changes in the plans for the development of New Jersey as now matured by the separate interests. An official statement is expected to be issued in a few days.

PERSONAL MENTION

MR. ARTHUR W. WARNOCK has been appointed to the position of general passenger agent of the Twin City Rapid Transit Company, a newly-created office.

MR. J. A. BRETT, of Chicago, has been appointed district manager for the Westinghouse Electric & Manufacturing Company, with headquarters in the Traction Building, Cincinnati, Ohio.

MR. THEODORE McCONNELL, for sometime past manager for the Texarkana Traction Company, of Texarkana, Tex., has tendered his resignation, and leaves shortly for Canyon City, Col., where he has accepted a position as manager for the Cripple Creek district, of the Colorado Light & Power Company.

MR. F. J. BOEHM, who has been in the employ of the Milwaukee Electric Railway & Light Company upwards of twenty years, has been appointed to the position of auditor of the company, to succeed Mr. H. C. Mackay, who, as announced last week, has accepted the position of comptroller and auditor of the Virginia & Carolina Coast Line Railroad.

MR. B. B. PIERCE, who for the past two years has been chief engineer of the Mansfield Railway, Light & Power Company, of Mansfield, Ohio, has been appointed superintendent of the company. He will still retain his former duties and enter upon his new ones on Feb. 15. Since the property has been under the control of the H. M. Byllesby Company it has been thoroughly overhauled in all its departments.

MR. W. A. GIBBS, general manager of the Zanesville Railway, Light & Power Company, of Zanesville, Ohio, has been appointed general manager also of the Columbus, Newark & Zanesville and the Columbus, Buckeye Lake & Newark roads, succeeding Mr. J. R. Harrigan, who has become general manager of the Canton-Akron system. A few evenings ago the employees of the Zanesville Company presented Mr. Gibbs with a fine gold watch.

MR. JAMES McCREDIE, treasurer of the United Traction Company, of Albany, has been appointed secretary-treasurer of the company by the board of directors. The office of secretary has been vacant since the formal transfer of the property to the Delaware & Hudson Railroad. Mr. McCredie has been treasurer of the company for a number of years, and his reappointment, with the added responsibility of the secretaryship, is a recognition of his efficiency.

MR. C. K. JEFFERIES, superintendent of the Indianapolis & Northwestern Traction Company, has been transferred to the superintendency of the Indianapolis & Eastern Railway, to succeed Mr. W. R. McKown, and Mr. Raymond Reynolds has become superintendent of the Indianapolis & Northwestern Company. Mr. C. E. Morgan, purchasing agent of the Indianapolis & Eastern Company, has been made superintendent of the Indianapolis & Martinsville Company, and also of the Indianapolis & Plainfield Company.

MR. JOHN M. WALKER, for a number of years chief engineer of the Pennsylvania & Mahoning Valley system, of Youngstown, Ohio, has resigned to become chief engineer of the Lima & Toledo Traction Company, with headquarters at Lima. This is one of the companies of the so-called Widener-Elkins syndicate, and it is building a line from Lima to Toledo. Last week the engineering force of the Mahoning Valley system tendered Mr. Walker a surprise at his home at Girard, Pa., and presented him with two leather chairs.

MR. WALDO H. MARSHALL has resigned as general manager of the Lake Shore & Michigan Southern Railway and accepted the presidency of the American Locomotive Company, the duties of which position he entered upon Feb. 15. Mr. Marshall was at one time associate editor of the "Railway and Engineering Review." Subsequently he became editor of the "Railway Master Mechanic." He left the latter journal to become editor of the "American Engineer," which position he resigned to enter railway service, for which his habits and opportunities of observation and study, together with his native ability, had eminently fitted him. From assistant superintendent of motive power of the Chicago & Northwestern, he became superintendent of motive power of the Lake Shore & Michigan Southern in June, 1899. In February, 1902, he became general superintendent, and in July, 1903, general manager. He will be 42 years of age at his next birthday.

MR. L. B. STILLWELL has been appointed electrical director in charge of the electrical engineering of the various Belmont properties in and near New York City. These include the Interborough Rapid Transit Railway, Section No. 1, which is the subway down to City Hall; the Interborough Rapid Transit Railway, Section No. 2, which is the section from City Hall to Brooklyn; the Manhattan Elevated Railway; the New York & Queens County Railway, of Long Island City; the New York City-Interborough Railway, of the Bronx; the New York & Long Island Railroad, which is popularly known as the "Steinway Tunnel"; the Long Island Electric Railway Company, which owns an electric railway between Brooklyn, Jamaica and Far Rockaway; the New York & Long Island Traction Company, which owns an electric railway between Mineola, Hempstead and Freeport, and the City Island Railway, which is at present operated by horses.

MR. V. W. BERRY, master mechanic of the Houston Electric Company, was born in Brownville, Me., in 1878, and was educated in the public and high schools of that town. Shortly after his graduation from the high school, in 1897, he entered the construction and repair department of the Lynn & Boston Street Railway, and the following year was promoted to the position of master mechanic. Here he remained until 1901, when he became assistant electrical engineer of the Boston & Northern Railway Company, with general offices in Lynn, Mass. Mr. Berry resigned from that company in April, 1903, to become electrical engineer of the Berkshire Street Railway Company, of Pittsfield, Mass., for which he superintended the installation of the substations and general electrical equipment. In November, 1904, Mr. Berry accepted the position of master mechanic of the Houston Electric Company, of Houston, Tex., owned and controlled by Stone & Webster, of Boston, Mass., in which capacity he is at present employed.

MR. H. M. BRINCKERHOFF has become associated with the firm of William Barclay Parsons, consulting engineers, 60 Wall Street, New York. Mr. Brinckerhoff is best known in the electric railway field through his long connection with the Metropolitan West Side Elevated Railway Company in Chicago, of which he was general manager from 1899 to 1905. Mr. Brinckerhoff was born in 1868, and graduated as a mechanical engineer from Stevens Institute of Technology in 1890. He gained practical experience with the West End Street Railway Company, in Boston, for over a year after graduation, doing all classes of electrical work from the line up. In 1891 he became assistant power house engineer of the Utica Belt Line Street Railway, where he remained for about six months, after which he became a construction man for the Thomson-Houston Electric Company. On July 1, 1892, he was made assistant electrical engineer of the Intramural Railway of the World's Columbian Exposition at Chicago, under Mr. Chas. H. Macloskie. He assisted in designing, planning and installing all the details of this first third-rail electric railway in America. He was a joint patentee with Mr. Macloskie of the various new devices developed in this system, and since used on the numerous third-rail systems in this country. He had charge of the maintenance of cars and power houses during the operation of this road until the close of the exposition. About this time the decision was made to equip electrically the Metropolitan Elevated, then being built in Chicago, and he became electrical engineer of this, the first commercial elevated road to be electrically equipped. In 1896 he had added to his duties those of superintendent of motive power, and in 1897 those of superintendent of way. In 1898 he was made assistant general manager and in 1899 general manager of the company. He has just returned from a three months' trip abroad, during which he inspected the various electric railway and power installations in England and on the Continent. His new work with the firm will be in the line of his past experience. He will have in charge their electrical and mechanical engineering, and especially the examination of new projects or existing properties.

H. M. BRINCKERHOFF

Street Railway Journal

Vol. XXVII. NEW YORK, SATURDAY, FEBRUARY 24, 1906. No. 8.

Published Every Saturday by the

McGraw Publishing Company

Main Office:

NEW YORK, Engineering Building, 114 Liberty Street.

Branch Offices:

Chicago: Monadnock Block.

Philadelphia: Real Estate Trust Building.

Cleveland: Cuyahoga Building.

London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York"; "Stryjourn, London"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada, Mexico and the Canal Zone.

Street Railway Journal (52 issues)............................$3.00 per annum

Single copies .... 10 cents

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August & November) $4.00 per annum

Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy)........................$6.50 per annum

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues), postage prepaid.................... $6.00

25 shillings. 25 marks. 31 francs.

Single copies ....20 cents

Remittances for foreign subscriptions may be made through our European office.

NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the Street Railway Journal.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires.

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal 8500 copies are printed. Total circulation for 1906 to date, 66,000 copies, an average of 8250 copies per week.

Shop Lighting by High-Candle-Powered Units

The importance of good lighting in street railway repair shops is still far from appreciated in some quarters, and although we have called attention to this matter before, it would seem worth while to find out if some of the high efficiency lamps now on the market could not be used to good advantage in those shop departments where accurate work is an essential feature of rolling stock maintenance. The Nernst lamp, for example, is being used with considerable success in general machine shop work, and the metallized filament lamps are certainly being tried out pretty thoroughly in installations where the ordinary 16-cp lamp is too inefficient and too small for good general illumination over large areas from a single unit.

On a street railway system it is a natural course to use the same style of lights in the shops as upon the cars, and as power is cheap and easily drawn from the trolley line, it is often considered of little consequence to give much thought to the quality of the light at the bench and pit. Efficiency is not the main point in such cases. Convenience is the object most sought. With the concentration of light found in the new types of lamps, and the frequent availability of both alternating and direct current for shop supply purposes, there ought to be a good field for experiment in the way of securing better light for the important work of equipment repairs.

Car House Protection

We have many times preached upon the defective condition of car wiring as it is found on those roads which do not pay especial attention to this subject, and we propose to say something upon a subject of equal, if not greater, importance from a fire insurance standpoint, viz., the maintenance of the wiring and the general condition of the car house. When defective car wiring develops a short-circuit on the road and an arc results, it may destroy a single car. Defective conditions of the same kind in the car house, whether in the building itself or when in part of a car equipment, imperils many cars. An excuse is hardly needed, therefore, for touching upon this topic.

Car house construction has undergone a continuous evolution from the time that horse car barns were considered amply sufficient to shelter the new rolling stock. The first step away from the old barn was toward securing wide areas in the car houses. Sometimes as many as 100 cars were stored in what was then considered and called fireproof construction, but which consisted of brick walls surmounted by a slate roof which was carried on light steel girders with wide spans. This form of car house soon proved to be more objectionable from a fire insurance standpoint than even the old horse car barn with its slow-burning wooden construction, and in the reaction which followed from the so-called fireproof construction of five or six years ago, some companies have gone to storing cars in the open. We do not intend to present here a discussion on fireproof construction, but to mention a few of the undesirable features which are often seen in street railway car houses.

To begin at the bottom, a basement is usually an undesirable adjunct in a car house, as it nearly always becomes a receptacle for the storage of various kinds of rubbish, and sometimes even of more inflammable material, like oils and paint. For the same reason a second story should be avoided if possible, even when used for office purposes or for employees. A second story is not always so easy to avoid as a basement, but where there is plenty of space, the advantages of placing employees' rooms, winding departments and even offices elsewhere than on the second story are obvious. The best design for a car house is generally admitted to be a one-story building divided into fireproof sections not exceeding 10,000 sq. ft. in area, and provided with ample facilities for the speedy removal of cars under all conditions. To this can be added as desirable auxiliaries, protection by sprinklers, hydrants, watchmen and an efficient local fire department. In all consideration of car house protection, the fact should be remembered that a car is not only a very inflammable structure, but also one into which it is very difficult under ordinary conditions to get water quickly. For this reason all car house fires are very rapid; in most cases not more than from 35 to 40 minutes are sufficient to accomplish the work of destruction. Hence the fire-fighting apparatus should be so arranged that it is quickly available, and a few extra hydrants equipped with reels of hose and extinguishers of various kinds will often prevent a disastrous conflagration. The day of the open pail filled with water, which is liable to freeze, has passed.

Owing to the inflammable condition of its contents, there is no portion of the system where a higher premium is paid for cleanliness than in the car house. The pits are an especial danger on this account. The floor and sides of the pit when of wood usually soon become soaked with oil and grease, and if the pit is also made the recipient and catch-all of loose paper and waste, it constitutes a serious source of danger. This is particularly true where the pits communicate with each other. The same precaution should be observed in transfer-table pits, especially where the transfer table is operated from conductors in a conduit, as waste paper often accumulates in the conduit or pit and is liable to be set on fire by sparking from the underground trolley.

Feeder Problems in Large Cities

The design of feeder layouts for heavy city service is very far from being an academic problem, with Ohm's law as the solvent. It is, of course, important to figure voltage drops in urban feeders over a wide range of loads, in order to determine the size of wire which should stand as the minimum permissible cross section, but after this has been done, it is high time to get out the map of the entire system of trolley wires and existing feeders, including section insulators and street switches, and to co-ordinate the proposed additions or changes with the regular and emergency car service. Inexperienced technical graduates often fail to realize in work of this kind the immense importance of keeping the traffic perpetually on the move.

Two extremes of feeder layouts are worth considering in heavy urban service. One of these is the plan of tying the whole system together, and thus multiplying all the routes at the bus-bars with innumerable cross connections between the outgoing lines, so as to secure the most economical service with the lowest feeder investment. As long as no heavy short-circuits occur between the positive lines and the ground return, this arrangement is certainly efficient in handling localized peaks, and in a general way holding up the voltage all over the system, but when trouble comes—and no section of an overhead system can be insured against breakage or crosses with foreign conductors—it is frequently the case that the entire system is seriously disturbed. If the short-circuit can be burned off, the paramount evil of a general shutdown may be avoided; if not, the saving in first cost may quickly be wiped out and turned into a considerable loss by the revenue missed through the blockade and stoppage of the cars. Such a system leaves the power house force practically helpless in case of severe line troubles.

The other plan consists of feeding every section of the system with a separate line from the power house, thereby localizing any trouble which may occur upon the positive side of the distribution layout. With a very large number of sections, the load per section can be taken care of efficiently if the individual feeders are designed to handle the traffic without heavy voltage drops when the cars are bunched, and in case of a broken trolley wire or a grounded feeder, the switchboard attendants have no cause to fear a general short-circuit, unless the breakers fail. Any extreme design of this kind lacks flexibility unless jumper connections with special street switches are installed, and the investment and maintenance are likely to be large.

The layout most capable of meeting the requirements must, then, fit into the existing system with some measure of flexibility, if it is to be satisfactory from the operating standpoint. A certain amount of tying sections together is imperative, if the emergency conditions growing out of break-downs and blockades are to be overcome. The location of each line with respect to the traffic of the system as a whole, the nearness or remoteness of intersecting or parallel lines, the through service to be handled, facilities for isolating the sections in case of fires along the route, and the possibility of traffic being diverted in case of paralysis upon some adjacent part of the system—these are the conditions which determine the feeder layout in great cities, rather than nice balancings of theoretical annual power losses, arbitrarily figured at so much per kw-hour. It is not necessary to employ the differential calculus in order to realize that blockades are vastly more expensive than the integrated power losses of any small group of feeders. Whether a city be laid out upon the radial or the checkerboard plan, these points hold, but the key to the whole matter is the map of the system rather than the slide rule. Exhaustive calculations are valuable enough in their way, and certainly cannot be entirely dispensed with in a proper feeder design, but the crux of the solution is that compromise between the above extremes which will insure the maximum operating flexibility.

Two Papers on Heavy Electric Traction

Two papers on this subject have recently appeared, one of which we abstract in these columns. Both are characterized by a gloomy view of the possibilities of electric traction, and cannot exactly be commended as cheerful reading for the electrical engineer. The first is a paper by Mr. Muhlfeld, before the New York Railway Club, dealing with the comparative results obtained on the B. & O. system with electric and with steam locomotives. The author is one of the very few men to whose lot it has fallen to have considerable practical experience with both types of machine, and hence his opinions, were they thoroughly unbiased, should carry considerable weight. Mr. Muhlfeld, however, labored under the disadvantage of having first, the earliest large electric locomotives, second of operating them in tunnel work under conditions that forbid high-plant efficiency and do not tend to economical operation of the locomotives, and third, he has, to judge from his requirements laid down for electric locomotives, a somewhat strong bias against them. He has, in fact, fallen into the error common among railway men of demanding not that the electric locomotives should have operative qualities as good as or better than those of steam locomotives, but that they should have also properties that would never be demanded of a steam locomotive. In other words, they expect a machine with no failings of its own, and with all the virtues and none of the vices of the present engines. This makes a somewhat extensive provisional programme. For example, Mr. Muhlfeld demands a fire and collision-proof structure, made in separate sections, operable separately or together from either end of any section, having 60-in. drivers neither carrying the armatures nor geared to them, with a very high center of gravity, wheels interconnected so as to prevent their independent revolutions, capable of operating over foreign tracks, provided with automatic electric brakes, and devices for returning to the line energy acquired on down grades, and with a steam train-heating equipment. And he asks that this shall be simple in design and reasonable in first cost.

This is certainly a very nice requisition and we can hardly wonder that Mr. Muhlfeld is not enthusiastic about electricity. He gives, however, some figures on performance that are not without interest. The electric locomotives were charged with an expense of $34.50 per 100 miles of run, of which $6.10 was the amount chargeable to running and shop repairs. They were, however, machines that had seen several years of hard service. The big duplex compound steam locomotives, with which comparison was made, weighed half as much again as the electrics for a 5 per cent increase in maximum traction effort, made over three-quarters the mileage at a lower speed on less grades, and showed an estimated repair charge of $9.00 per 100 miles. They had, in addition, the advantage of a clear, straightaway run over open track, instead of continually struggling with the grades and special work of a long tunnel system. All in all, it does not strike us that the electric locomotives made such a bad showing, although Mr. Muhlfeld did not call particular attention to the fact he cites, and which are here brought together. A tunnel is not an easy field of operations, particularly when it is the sole field, and one would hardly expect a really good power-house performance, so that the repair bill becomes especially pertinent. It would be interesting to know the probable result of using the electric locomotives on the free run and the steam locomotives on the tunnel service. When the New York Central and the N. Y., N. H. & H. locomotives get into service, we shall have a much better basis for comparison of results, and we shall be much surprised if the electric machines do not give a good account of themselves, particularly in the matter of maintenance. The power-house conditions, too, will be much better than in Baltimore, and should enable the power to be far more cheaply supplied. Electric traction has intrinsic advantages in suburban work that makes it desirable in itself, but there is also good reason to believe that it can be made economical under favorable conditions elsewhere. Do not, however, ask it to achieve the impossible.

The second paper concerned, is one read before the British Institution of Electrical Engineers by Mr. Carter. It is a somewhat systematic account of the procedure of electric railway design, a bit academic in treatment, and characterized by a deeply cerulean view of the future of electric traction, unless carried out by the canonical third rail, low-voltage methods of the present time. Unquestionably, British conditions are somewhat different from American ones, especially in the drastic B. of T. regulations concerning drop in the rail return, yet we can hardly think that what is promising here is foredoomed to failure there. Especially is Mr. Carter a bear on the alternating-motor question, damning with faint praise the whole tribe in all its ramifications. He takes the view, in fact, not unknown here, that alternating-current motors may be good enough for some other fellow under other circumstances, but are altogether wrong here and now. Now we hold no brief for the a. c. motor and, in fact, have now and then raised the ire of its friends by asking for results instead of calculations, but we do not believe Mr. Carter's views as to its great cost, outrageous weight and low efficiency are based upon fact. He mentions one matter of interest, which has been little referred to in this country—the track booster system available in single-phase work for transferring the voltage drop from the rails to the insulated conductor. The rails are broken at intervals by insulating joints and the current is led around a current transformer of unity transformation ratio with its second winding in the feed circuit. It seems hardly necessary, however, to have recourse to so intricate a scheme when it is so easy to raise the working voltage to a point where the current in the rails ceases to be formidable. There may be in future practice cases in which the alternating return current must be considerable enough to require the boosting system, but they are hardly in sight yet.

Continuing his rather cheerless view of the situation, Mr. Carter holds to the belief that British railroad systems are not well suited to electrification. About this there must naturally be considerable difference of opinion, but broadly viewed it would appear that a region of comparative short distances and dense traffic was not altogether a hopeless situation for electric traction. We grant that if all railway electrification must be done by the third-rail system at low voltage, the outlook is bad in England or anywhere else. Such, however, we do not believe to be the case, and when one begins to work at high potential with overhead conductors the difficulties begin to disappear. Certainly we shall be hopeful until we see some reason for retrogression to low voltage. The electrification of railways, in general, is obviously a tremendous task, and it may never be carried out in its entirety. Each year, however, sees some advance made in the right direction and the past few years in particular have been full of hopeful signs. When the New York suburban service on the Central, New Haven and Erie railroads is given over to electricity, and the electrified lines begin to stretch out into the open country, there will be a demonstration of heavy electric traction that will not be without its effect. Special work in tunnels and yards is only a stepping stone on the general road. From the technical standpoint, the key to the situation is in high-line voltage carried clear through to the cars, and it is surely coming, if not by present methods then by improvements upon them. It is not so many years ago since electric distribution of power from Niagara was pronounced impracticable by high authorities, and now we have trunk lines negotiating for Niagara power with something more than bob-tailed trolley cars in view. It is a long road to the bigger electric traction, but it will not end in a blind alley.

KINKS AND PRACTICE IN THE CHICAGO & JOLIET ELECTRIC RAILWAY SHOPS

The variety of problems to be met in a street railway shop is so great and the time for solution sometimes so small that the master mechanic cannot possibly be previously prepared for every occasion. He is frequently compelled to exercise considerable ingenuity and inventive genius in devising means to meet new problems. Some of the methods employed by G. S. Patterson, master mechanic of the Chicago & Joliet Electric Railway, in this department of railway work at the shops of the company in Joliet, and an account of certain features of his shop practice may be of interest to others.

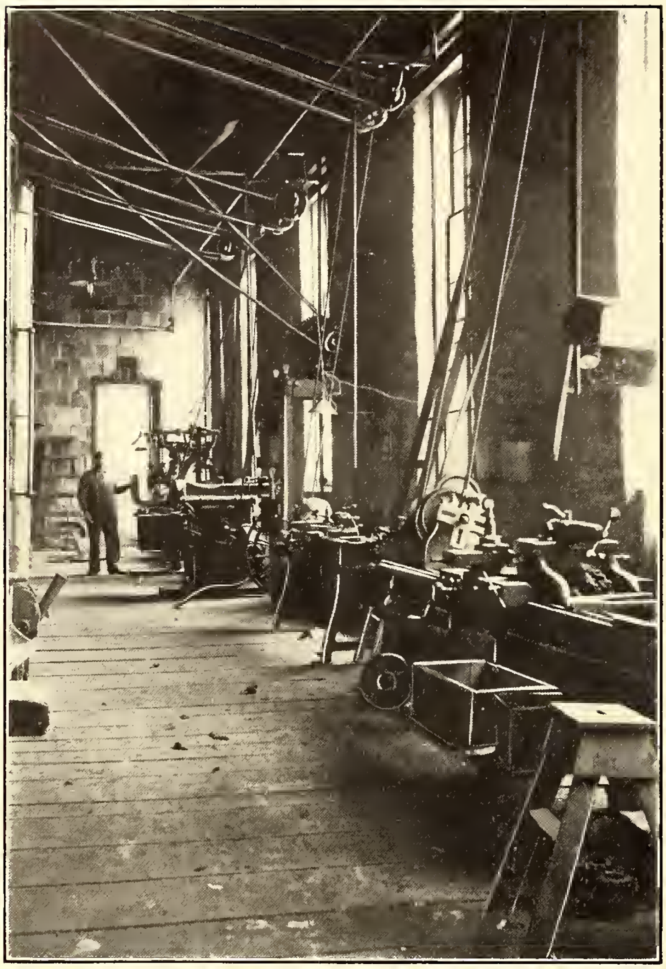


FIG. 1.—MACHINE TOOLS DRIVEN BY ONE MOTOR

CLEANING CARS

The exteriors of the cars are washed with a hose. This work is carried out on a special washing floor of concrete, which slopes toward a drain, and is conducted by men who also clean the spittoons. For taking care of the interior of the cars, women are employed. Mr. Patterson states that women do the work in a much more satisfactory manner, are more thorough than men; that they work conscientiously, and, in fact, require no attention or direction except when special work is to be done.

LIGHTING OF MACHINES AND BENCHES

The machine tools are arranged along one wall and derive power from one motor through line shafting placed well overhead. The proper lighting of machines and work benches is well demonstrated in the machine room. The view of the carpenter's bench, Fig. 2, shows what can be done in this direction. The aim here has been to supply enough light, to distribute it properly and to put it where it will be thrown on the work without casting shadows. Ten lights are employed; these are set in an inverted trough, which is painted white, and which acts as a reflector. The light is well distributed, and is placed just high enough to prevent glare to the eye, yet low enough to prevent one's shadow being cast on the work on the bench.

A good method of lighting an individual machine is illustrated in Fig. 3, which shows the circular saw table. In this case a cluster of lamps with a large enameled reflector is placed directly over the saw. The cut of the saw is therefore always visible, as there is no occasion for the operator to get between the light and the saw. In lighting the lathe where commutators are turned, a cluster of ten lamps is employed. This cluster is provided with a tin reflector, and is hinged on an arm which extends from the wall in such a manner that the light may be thrown where needed. The apparatus is crude, yet it serves the purpose well.

ARMATURE TESTING

The armature room presents several interesting features. A method of testing armatures, which is illustrated in Fig. 4, has several advantages over those usually employed. The terminals from a battery and bell are placed on segments between which are two intervening segments. The terminals of a head telephone are placed on these two intervening segments.

FIG. 2.—LIGHTING OF CARPENTER'S BENCH

The bell causes a pulsating current to flow through the whole armature. If the armature coils connected to the segments on which the telephone terminals are placed are all right, a faint buzzing sound, induced by the voltage drop between the two segments, is heard in the telephone. Should the segments be shortened, there is, of course, no sound. In the case of an open circuit, the telephone terminals are subjected to the total drop through the armature, and a loud noise in the telephone results.

If two top or two bottom leads are crossed, the telephone is silent, acting the same as when two segments are short-circuited. Crossing the coils causes two segments on opposite sides of the armature and two connected coils to be isolated from the rest of the winding. When one of the telephone terminals is on one of these segments, no current will pass through the telephone, as the circuit is open. Such a cross may be distinguished from a short-circuit, however, by first placing one of the terminals of the bell on the same segment with one of the telephone terminals, and then, if no sound is heard, returning this terminal to its original segment and placing the other bell terminal on the other telephone terminal. If no sound is heard in either case, the defect is a short circuit. A sound in either instance indicates a cross. With a little practice and some reasoning, practically all the rough armature tests can be made with this instrument as with a milli-voltmeter. The box containing the battery bell is also provided with five incandescent lamps, and when required it may be used as an ordinary lamp bank.

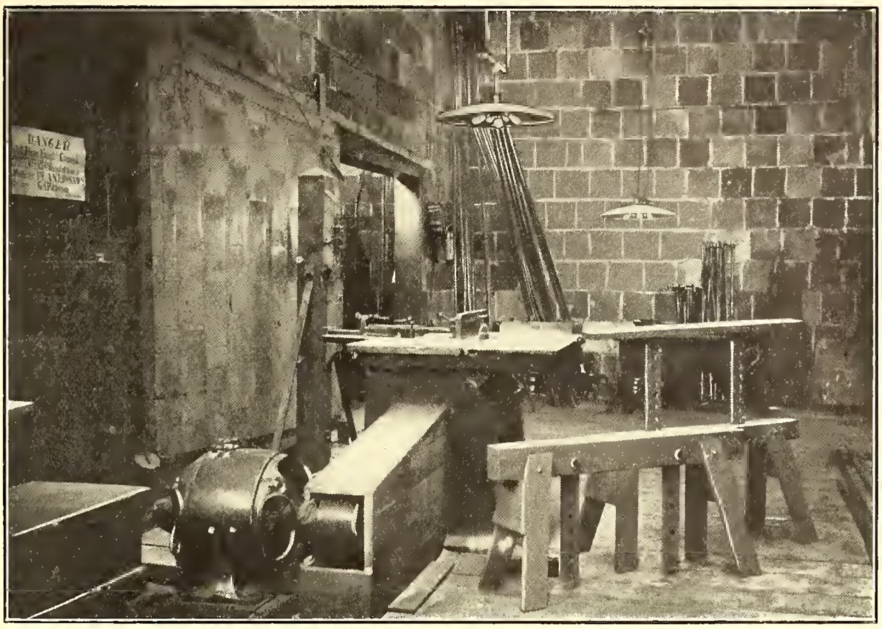


FIG. 3.— LIGHTING CLUSTER FOR THE CIRCULAR SAW TABLE

For testing field coils a New Century testing outfit is employed. The instrument is connected by means of a cord and socket into an incandescent lamp circuit on the car, and the fields are tested while in the motor.

A HANDY ARMATURE CART

An armature cart employed about the shops is shown in Fig. 5. This was described at some length by Mr. Patterson in the Street Railway Journal of Feb. 6, 1904. It was constructed at a cost of about $10. Two 40-in. buggy wheels are placed 20 ins. apart, and the armature is picked up by means of a system of levers. As the ratio of these levers is 13 to 1, the operator is not required to strain himself. When the armature is once picked up, the cart balances itself, as the armature hangs below the axle.

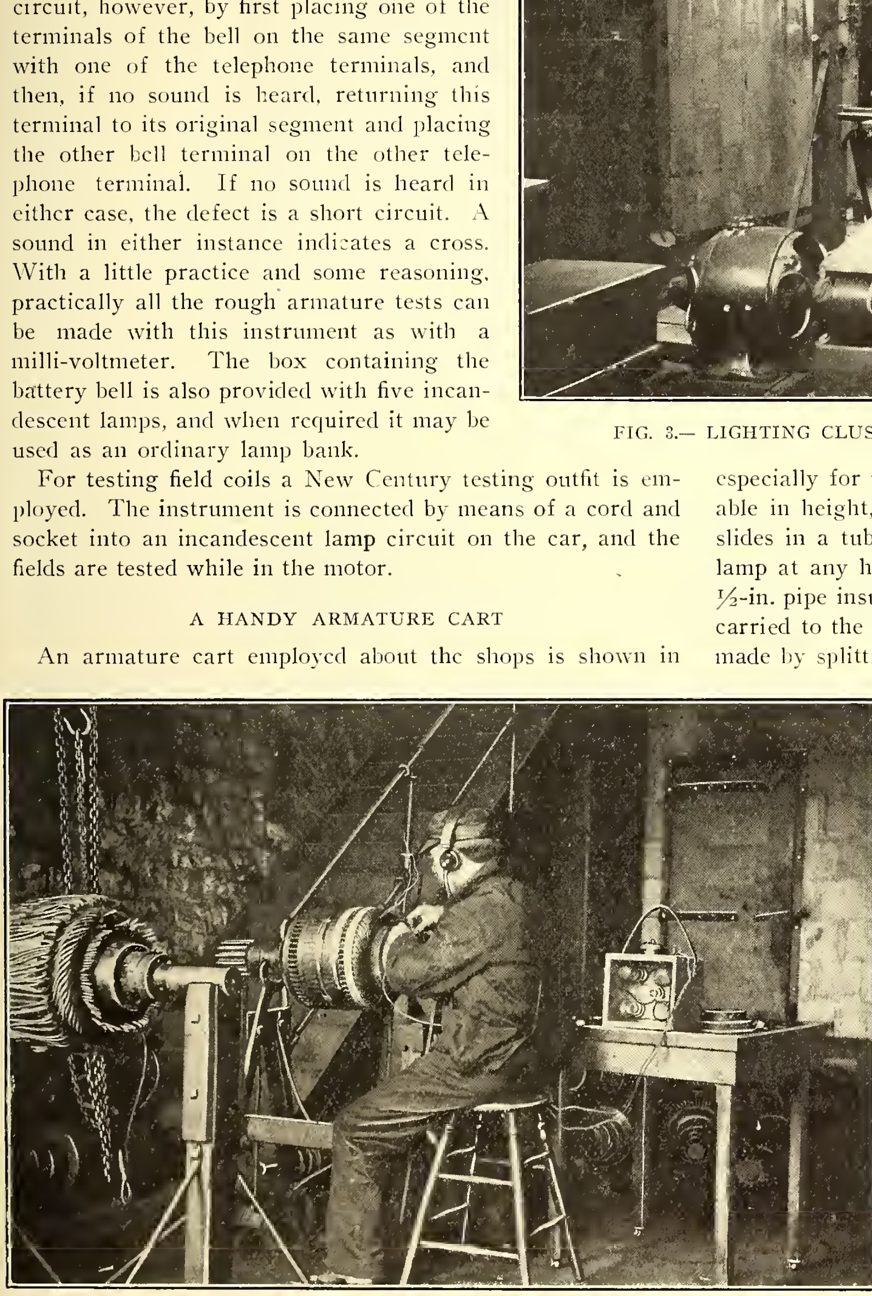


FIG. 4.—ARMATURE TESTING WITH A TELEPHONE

PORTABLE LIGHT STANDS AND CLUSTERS

Some handy light stands, Fig. 6, have been constructed especially for use in the paint shop. These are made adjustable in height, and consist primarily of a ½-in. pipe, which slides in a tube of proper size. A thumb screw fastens the lamp at any height desired. A wood plug in the top of the ½-in. pipe insulates the lamp from the holder, the wires being carried to the lamp through a hole in the plug. The feet are made by splitting the end of a ¾-in. pipe into three sections and spreading them in the proper shape. A portion of the pipe is not split, and into this portion the tube previously referred to is riveted. When desired the ½-in. pipe carrying the lamp may be removed from the stand and the lamp can then be used as an ordinary drop light. As constructed, these stands are made with an adjustment of about 2½ ft. They can be placed up close against a car, where light is needed for lettering or striping, and have been found very convenient for many purposes.

A cluster of lights, Fig. 7, found very useful in pit work has the five sockets mounted on a board. A second board of fibre, placed over this mounting and flush with the end of the sockets, carries a reflector of tin. The space between the boards serves as a reel for the trolley and ground wires. A snap switch placed on the board makes it unnecessary to pull the trolley off the wire to put the lights out. If an extension light is needed, the plug is screwed into one of the sockets, as shown in the illustration. Those in use about the shop have the cord covered with rubber tubing, as a precautionary measure.

AN ADJUSTABLE HEADLIGHT BRACKET

Mr. Patterson has placed a rather useful headlight bracket on the line cars. This, as may be observed in Fig. 8, admits of adjustment to any angle within a limit of about 45 degs. The light may be permanently set in any position by means of a pin inserted in holes in the arc and in the handle or lever.

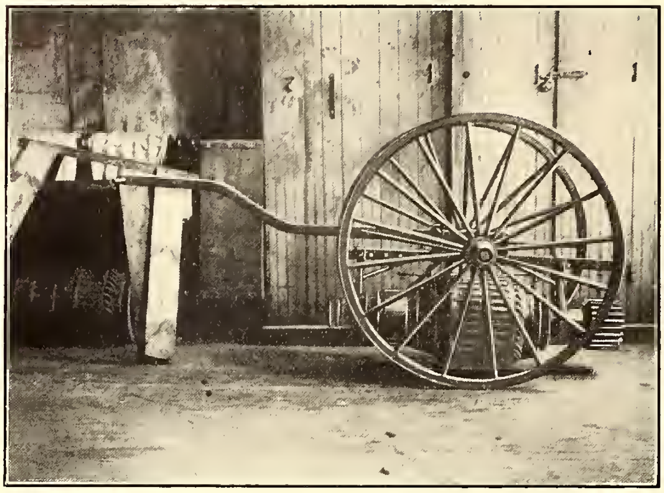


FIG. 5.—AN ARMATURE CART WHICH ELIMINATES HEAVY LIFTING

The mechanism is comparatively simple, and the general principle may be gathered from the illustrations.

WATTMETERS ON CARS

Recording wattmeters are placed on all of the interurban cars of the system. Readings are taken each trip and entered up similarly to register readings. Notices are posted on the bulletin board each month, giving the consumption per carmile of each man. The readings also check any irregularities in the motor. On one occasion they were the means of discovering too closely adjusted brakes. One motorman, who was known to be very careful, remained for a long time at the foot of the list as regards current consumption. This aroused suspicion, and an investigation showed that the man was in the habit of readjusting his brakes, setting them up closer, after the shop men had passed over the car. When the practice was stopped, the man's current consumption record fell at once, and he now retains a place near the top of the list.

For quite a period considerable inconvenience was experienced through burning out of the wattmeters by lightning. To prevent this, an additional choke coil and lightning arrester were installed on top of the car in the circuit just after leaving the trolley stands. Since making this change but one wattmeter has been lost through lightning.

CARE OF HEADLIGHTS

Mr. Patterson has found that better results are obtained by letting the motormen take care of the arc headlights. When headlights were trimmed in the shop, men were continually being sent from the shop to repair them on the road. Usually the trouble was something trivial, which the motorman, had he been at all familiar with the light, could have repaired without help.

Since the practice of letting the motormen care for their own lights has been adopted, the men have become familiar with the mechanism of the lamps, and many needless calls on shop men have been obviated.

NIGHT WORK

Night work has been abandoned as much as possible in the shops. Usually but three men are employed at night. These men take register readings and clean those cars that cannot be gotten at during the day.

FIG. 6.—ADJUSTABLE LAMP STANDS FOR USE IN THE PAINT SHOP

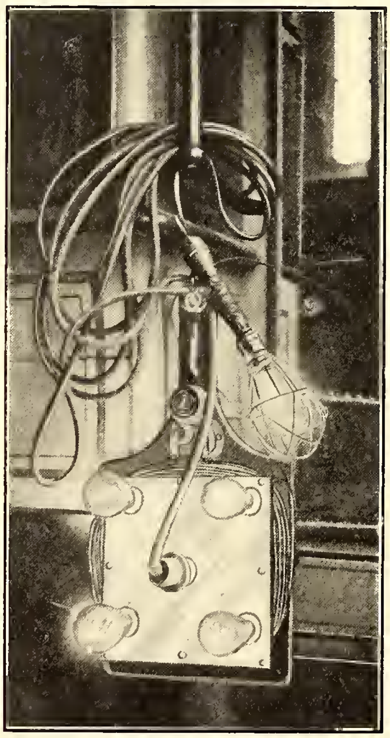


FIG. 7.—LAMP CLUSTER FOR PIT WORK

FIG. 8.—ADJUSTABLE HEADLIGHT BRACKET FOR LINE CAR

The Toledo, Port Clinton & Lakeside Railway Company will institute an express and freight service beginning March 1. Cars will be operated over the Lake Shore Electric Railway from Genoa, but the business will be independent of the Electric Package Company, which handles the business on the Lake Shore Electric.

RECENT TESTS WITH A 15,000-VOLT, SINGLE-PHASE LOCOMOTIVE IN SWITZERLAND

The announcement of the intention of the New York, New Haven & Hartford Railroad Company to use an 11,000-volt trolley wire, calls for renewed attention to the Seebach-Wettingen railway in Switzerland. This line, whose electrical equipment was compared to that of the New Haven road, in the editorial on the New Haven electrification which was published in the issue of Feb. 17, has been in operation since Jan. 16, 1905. It is a part of the railroad system owned by the Swiss government, from which the Oerlikon Machine Works received permission more than a year ago to equip a section of track between Seebach and Wettingen, a distance of over 15 miles. Up to the present, the electrification has been carried from Seebach only as far as Affoltern, a distance of 2.4 miles, and the tests mentioned below have been conducted upon this section of track.

Since the last account of this road in the Street Railway Journal (see April 8, 1905), a number of important changes have been made. At that time 14,000 volts were used. The e. m. f. has since been raised to 15,000 volts. Experiments have also been conducted upon carrying the trolley wires in a number of ways, and the latest is by catenaries mounted on steel bridges spanning the track, upon practically the same plan as that decided upon for the New Haven line. In fact, the view of the road shown in the accompanying engraving gives a very good idea of the future appearance of the New Haven railroad.

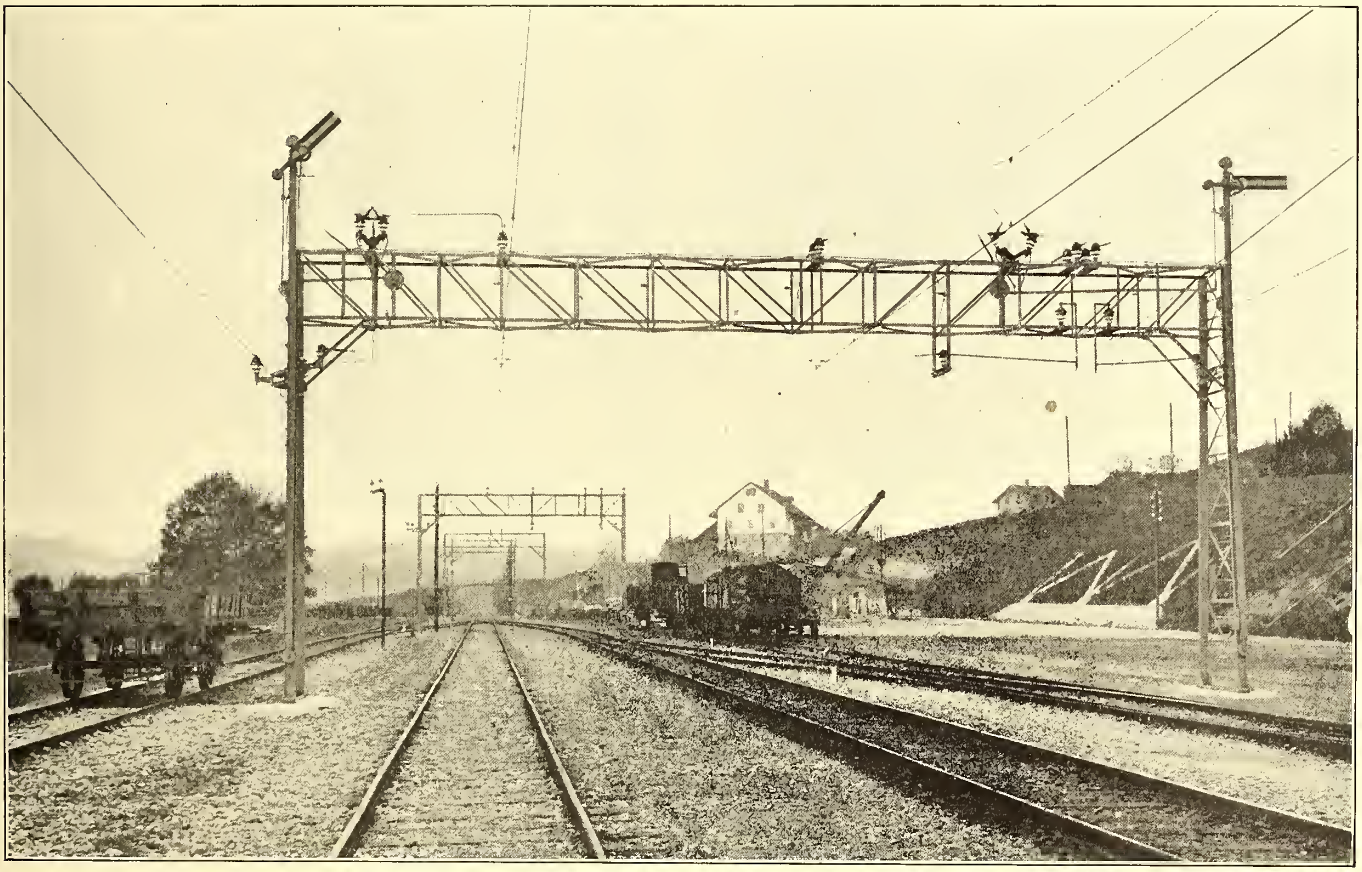
Experiments have also been conducted with two types of locomotives. At the time that the article in the issue of April 8 was published, the company was using a Ward-Leonard converter locomotive, which took single-phase current at 14,000 volts from the trolley wire, and had also just finished the design of an electric locomotive equipped with series-commutating, single-phase motors. Before describing the details of the new locomotive it may be of interest to present the following data covering the amount of work done by each of the locomotives during the period indicated.

Record of Work Done.	Converter Locomotive. Jan. 16 to Oct. 1, 1905.	Single-Phase Locomotive. Oct. 1 to Dec. 1, 1905
Days trips were made	164	51
Trips made	1,442	304
Train-km. made on test division, including switching	4,850	997
Gross ton-km. carried	496,000	135,209

It is stated that during this time not a single defect appeared in the insulation of either locomotive.

From the illustration of the locomotive on the next page, it will be noted that the current collectors comprise four flexible rods mounted in pairs on longitudinal supports. These supports are so placed that one pair of rods collects current when the power wire is carried on poles on the right hand side of the track, and the other pair when the power wire is on the left. The methods of insulating the collecting rod from the locomotive and its pneumatic control, were described in the previous article referred to, but an improvement has been made in the rod itself. It now consists of a split-steel tube, with the convex side turned up and arranged to hold a piece of brass at the contact end. This piece of brass, which is fastened with three small screws, collects the current and is the only part of the rod subject to wear. For protection against lightning, the locomotive carries choke coils, horn lightning arresters and liquid resistances. The choke coils and arresters are mounted on the roof.

After passing an automatic circuit high-tension breaker, which is located under the roof, and which can also be actuated either mechanically or pneumatically from the motorman's compartment, the current passes to a pair of air-



A VIEW ALONG THE SEEBACH-WETTINGEN 15,000-VOLT, SINGLE-PHASE LINE, SHOWING THE FORM OF OVERHEAD CONSTRUCTION BY CATENARIES CARRIED ON BRIDGES SPANNING THE TRACK cooled transformers placed in the middle of the locomotive. All of the high-tension wiring is placed in micanite tubes, which are of such insulating strength that they may be touched with impunity. These transformers reduce the voltage from 15,000 to 750, and each has a full load capacity of 200 K. V. A. The return circuit of the high-tension circuit is through the locomotive truck and the rails.

MOTORMAN'S CAB OF 15,000-VOLT, SINGLE-PHASE LOCOMOTIVE

Two systems of control have been installed for experimental purposes. One is the tap method, and twenty-one taps are used from the 750-volt secondary, which would give a difference in potential between consecutive taps of 37.5 volts. The outside taps are also lead to an induction regulator of the usual type, which is controlled from the motorman's cab through a hand wheel by means of a shaft and worm gear. The tap controller is also operated by a hand wheel in the motorman's cab. Only one of these controllers will be used in the final equipment. It will be so arranged that it can be operated electrically from the motorman's stand.

From the controllers the current passes to the motor switches and thence to the motors, which are of 200-hp each, at 650 r. p. m. They are of the series-commutator type, and each has 8 poles with additional "inter-poles" for compensation. A description of the motors, together with some of their early performance curves, appeared in the STREET RAILWAY JOURNAL of April 8, 1905. The gear ratio is 1 : 3.14.

The air compressor for use with the Westinghouse brakes, current collectors, main circuit breaker and sanding and signaling apparatus, is driven by a 240-volt, 6-hp, single-phase motor running at 500 r. p. m. As under ordinary circumstances, the low frequency of 15 cycles would cause flickering in any lamp used, the lamps are designated for only 20 volts, and have such thick filaments that they retain their glow irrespective of the alternations.

Each motor is mounted in the middle of its four-wheel trucks, and the power is transmitted through gearing to a driving shaft which is connected to the wheels by side rods.

The total weight of the locomotive is 43 metric tons (946,000 lbs.); body and trucks, 23,500 kg (91,700 lbs.); electric equipment and brake apparatus, 19,500 kg (42,900 lbs.); motor, without the gearing, 3380 kg (7436 lbs.); induction regulator with base plate and gearing, 4000 kg (8800 lbs.); speed regulator with oil receptacle, 310 kg (682 lbs.).

This locomotive drew loads weighing 200 tons at 30 km speed on curves up to 8 per cent, without appreciable sparking at the commutator. The starting current, when the motors are connected in series, is about 1000 amps., and is about 780 amps. when the locomotive is running on an 8 per cent grade at 27 km an hour with the motors taking 450 volts.

THE REINCARNATION OF AN ELECTRICAL IDEA

Under this title Frank J. Sprague contributes an article to this week's issue of the "Electrical World," discussing the history of the modern inter-pole motor, and its adaptability to heavy electric railway operation at 1500 volts. Mr. Sprague refers to a number of his early patents on electric motor design, in which two sets of field coils are used. One set was normal. The other two poles were variable, dependent on the current flow through the armature, and their object was to prevent field distortion and consequent sparking at the brushes. The effect of this construction was practically to produce an inter-pole motor. This system was used by Mr. Sprague in both his stationary motors and elevated-railway motors built in 1886. With this system, he believes that electric locomotives can be used to restore energy to the line on down grades and that 1500 volts. d. c. in the motor can be employed without difficulty. He also believes that the compensating coils used on some commutating types of a. c. motors are for the same practical purpose and are consequently the reincarnation of his old method for neutralizing armature reaction.

VIEW OF THE 15,000-VOLT, SINGLE-PHASE LOCOMOTIVE ON THE SEEBACH-WETTINGEN LINE

LARGE ELECTRIC AND STEAM LOCOMOTIVE

An interesting paper on this subject was presented Feb. 16 before the New York Railroad Club, by J. E. Muhlfeld, general superintendent of motive power of the Baltimore & Ohio Railroad. The author first described the six electric locomotives owned by his company. Of these, Nos. 1, 2 and 3 each weigh 196,000 lbs. carried on four pair of driver wheels, and No. 4 is a small switching locomotive. These four have all been in service for the past ten years. Nos. 5-6 and 7-8, put into service about Sept., 1903, are specially designed freight train helping locomotives, each having a total weight in working order of 160 tons (80 tons per section), distributed over 16 driver wheels (8 per section), with a total wheel-base of 44 ft. 2¾ in. (14 ft. 6¾ in. per section), and two 14 ft. 6¾ in. rigid wheel bases. The driver wheels are 42 ins. in diameter, each pair being geared to a 200-hp, 625-volt motor, with ratio of gearing 81 to 19, providing for a total tractive effort at full working load on eight motors of 70,000 lbs., and at starting of 80,000 lbs., assuming 25 per cent tractive coefficient, giving a nominal rating of 1600 hp. These locomotives are equipped with electric air compressors for the operation of the brake, signal, third-rail, safety, cut-out switches, track sander, bell and whistle, and also with the usual steam locomotive equipment.

The source of power is a central steam plant generating direct current of 560 volts, from which it is transmitted through feed cables direct to the booster stations where the voltage is increased to 625 volts. The current is then conveyed to a storage battery which is used as a reserve and for peak loads, as well as to a surface third-rail system of contact line, equipped with safety cut-out device. The locomotive motors obtain about one-half the required current direct from the storage and booster stations.

The free running speed of these locomotives is about 20 miles per hour. On level track, with good current, rail and weather conditions, they are capable of moving a train weighing 3000 tons with a current consumption of 2200 amps., which consumption, when speed increases to about 10 miles per hour, reduces to about 900 amps. On a 1 per cent grade these locomotives, under similar conditions, will move a train weighing 1400 tons with a current consumption of 2200 amps., which consumption, when speed increases to about 10 miles per hour, reduces to about 1600 amps.

These locomotives handle eastbound through freight steam locomotives and trains at Baltimore, Md., from Camden Yard to Waverly, a distance of a little over 3.4 miles, returning light. This distance includes seven curves ranging from 5 degs. to 11 degs.; seven tunnels from 400 ft. to 7000 ft. in length, and gradient about as follows:

	Per Cent
The first 9,000 feet average	1
The next 2,000 feet average	1.4
The next 2,500 feet average	1.5
The next 4,500 feet average	.8

The time consumed when hauling freight trains weighing 1395 tons in cars of various capacities and lading, 105 tons in steam locomotives and 160 tons in electric locomotive, or a total moving load of 1660 tons, averages 23 minutes actual running time, from start until the electric helper locomotive cuts from the head end of the train to return light.

During the past one year's service the combined mileage of these two electric locomotives has been 121,015 miles, or an average of 5042 miles per month per locomotive, computed on the basis of straight light and loaded mileage. The proportion of light and loaded mileage was half and half, about 200 miles per month per locomotive was in passenger helper service.

Considering $1.25 per net ton as a base cost for fuel delivered at the power plant, the average total operating and maintenance expenses during the year for generating the current, the labor and material for the locomotive electrical and mechanical repairs, the engineer's wages, wiping, hostlering, inspecting, oiling, dispatching, lubricating and miscellaneous supplies, was approximately $34.50 per 100 miles run per locomotive. Of this amount, the average cost of labor and material applied to each locomotive for the running and shop repairs would be $3.20 or 52 per cent for the electrical, and $2.90 or 48 per cent for the mechanical, making a total average cost of $6.10 per 100 miles run for both the electrical and mechanical repairs. These figures do not take into consideration interest, depreciation, taxes nor insurance on the investment, nor do they include the expenses incident to the maintenance of such equipment as batteries, feeders, third rail, bonding wires, insulation, safety cut-out switches, extra motors, etc., which is not required for steam locomotive operation. The wages for conductor, or second man on the locomotive have also been omitted.

During their service considerably difficulty has been experienced with the shoes used for collecting the current from the surface third rail; the loosening, wear and breakage of pinions used to transmit the power from the motors to the gears on the driver-wheel axles; the lubrication, heating and wear at the armature bearings; the flange and tread wear of driver-wheel tire; derailments; stallings and breaking in two of freight trains due to slipping of driver wheels, more especially with wet rail or when tire of drivers connected in series are not of exact diameters, and in miscellaneous renewals and shop repairs.

The driver-wheel tires which when new were 2⅞ ins. thick, are now 1¾ ins. thick, showing only 7500 miles run per one-sixteenth inch metal removed at tread, and will have to be renewed within a few months.

From experience, to the present date it would appear that an electric locomotive and its source of power, to produce the proper efficiency and economy in operation for either passenger, freight or helper service should fulfill the following essential requirements:

(1.) A fire and collision resisting locomotive construction within the present clearance and weight limits; simple in design; reasonable in first cost; safe, reliable and economical for operation at varying speeds and power; and accessible for inspection, lubrication, cleaning, repairs and for replacement on track in event of derailment of any or all wheels, by the ordinary steam locomotive and car methods, without the necessity for the use of a power crane.

(2.) A locomotive that can be interchanged and operated over home and foreign tracks, which are suitable for steam locomotive or motor-car equipment.

(3) A locomotive composed of two or more interchangeable sections, each a duplicate of the other, and equipped so that each section may be operated from either end, and independenly or jointly, with any number of coupled sections; the operation under any arrangement to be controlled from a single section by one engineer.

(4.) The elimination of pilot wheels and the concentration of the entire weight on the driver wheels, with a maximum weight per wheel at the rail of 25,000 lbs.; and an arrangement of driver wheels providing for a short, rigid, and long, flexible wheel base, without excessive end play at axle bearings.

(5.) The elimination of armatures from locomotive driver-wheel axles and the transmission of power to driver wheels not less than 60-in. initial diameter without the use of gearing, in a manner that will insure the economical use of current at the motors for starting and running, and eliminate the accumulation of unbalanced pressure at the wheel and rail contacts, as well as the independent revolution of one or more pairs of driver wheels when coupled in series, which occur as the driver wheels become slightly different in diameter due to ordinary wear of material, when making transmission in current at motors, or when operating on slippery track or over rails, frogs and switches of varying wear, surface, alignment and elevation.

(6.) The least weight between the track and the locomotive frame-carrying springs, to minimize the pressures, lateral thrusts and wear at the rail and wheel flanges.

(7.) A high centre of gravity so that the vibration of the locomotive, due to the variation in surface, alignment, elevation and curvature of track can be absorbed by the weight suspended over the driver springs.

(8.) A proper proportion between the electrical, mechanical and dead equipment weight of the locomotive.

(9.) Locomotive motors compact, ventilated, cooled, protected from internal damage and mechanical injury, and of ample range of adjustment and capacity to permit of continuous operation at varying or full speed or power without excessive heating of armatures, commutators or field above the temperature of the surrounding atmosphere. A thin, tough and elastic insulation material, unaffected by humidity or a temperature of 400 degs. F., and having the requisite dielectric strength.

(10.) A development of the maximum locomotive power for rapid acceleration and regular working, requiring no transition, as from series to multiple, in the transmission of the current to the motors, and providing for a uniform increase or decrease in tractive power to prevent irregular drawbar stresses.

(11.) Suitable pumps to provide compressed air for the locomotive power brake, track sander, bell and signal operation, together with steam train heating device, and the other usual equipment.

(12.) Automatic positive devices on the locomotive to insure protection in event of accidental short circuit, or disablement of the engineer.

(13.) An arrangement on the locomotive which will automatically provide for electrical breaking and return to the line for the use of pulling locomotives, a considerable percentage of the energy that is generated by trains descending grades, or stopping, and which energy is ordinarily wasted in destroying material and equipment by brake-shoe action on wheels or rails.

(14.) A high potential current producing, and an aerial conveying system, reasonable in first cost and economical for maintenance; the generation of the electrical energy at a central plant for the least cost per kilowatt-hour; the transmission of the lowest current over the minimum amount of metal contained in overhead contact lines, protected for weather, voltage and lightning conditions, and insuring continuous operation in event of line or equipment failure or accident; the conservative use of battery as storage for extra power that can be generated at small cost during light load and utilized to good advantage during intermittent and peak loads; the least number of transformer or convertor stations; the minimum feeder, conversion and resistance losses in current, and the elimination of electrolytic action.

The speaker then described steam locomotive No. 2400, which is of the Mallet articulated duplex-compound type, and which has been in service on the Connellsville Division since Jan. 6, 1905. The total weight of 334,500 lbs. for the engine in working order is all carried on the driver wheels, which are 57 ins. in diameter. Including the tender, which has a capacity of 16 tons of coal and 7000 gals. of water, the total weight is 479,500 lbs. The drawbar pull is about 74,000 lbs. when working compound, and 84,000 lbs. when working simple. The locomotive is used for pushing or hauling freight trains on grades and a statement of its performance for one year from Jan. 6, 1905, to Jan. 6, 1906, both inclusive, follows:

Total locomotive mileage (computed on basis of 6 miles per hour when locomotive is in helper service, and straight mileage allowed when locomotive is handling through freight trains)	44,976 miles
Miles run per ton of 2000 lbs. run-of-mine, 20 to 40 per cent volatile bituminous coal used	9.26
Gallons of water used per 100 miles run..........	15,207
Pounds of water used per pound of coal consumed, at temperature of feed water....................	5.870
Miles run per pint of engine oil..................	145
Miles run per pint of valve oil...................	200
Miles run per pound of crank-pin grease.........	294
Miles run per ton of sand used..................	485
Cost for labor and material for repairs, per 100 miles run	$3.16

The average total operating and maintenance expenses during the year for fuel, water, labor and material for the locomotive repairs, engineer's and fireman's wages, wiping, hostlering, washing boiler, inspecting and dispatching, lubrication and miscellaneous supplies, was approximately $24.50 per 100 miles run. To this figure can be added an allowance on account of general repairs and renewals to locomotive, mileage credited but not actually run, difference in cost of fuel delivered at power plant and on locomotive tender, and for the mantenance of fuel and water supply plants, and there will still be a large margin in favor of the steam as compared with electric locomotive performance, under fairly similar conditions.

During the last six months of its year's service, Aug. 7, 1905, to Jan. 6, 1906, both inclusive, the locomotive was out of service eleven days on which no mileage was made, on account of boiler washing, staybolt tests, repairs, etc., due to ordinary wear and tear, or about 6 per cent of its time unavailable for transportation department work. Allowing for firebox and boiler-tube renewals, heavy machinery, repairs, etc., we estimate, from the last year's performance, that at the end of ten years the shop charges for working repairs will have averaged not to exceed 9 per cent per mile run. The threads of tires show even wearing amounting to 3-16 in., or about 1-64 in. per month; tires calipered uniform in diameter.

After describing in detail the condition of the locomotive at the end of the period mentioned, the speaker gave the following as some of the results that can be obtained from this compound-cylinder, articulated type of freight locomotive, which he states cannot be duplicated by other single units of steam, electric or internal combustion locomotives now in use on American railroads.

1. A tractive power of about 84,000 lbs. for starting heavy trains and for a speed of 5 miles per hour; and of 74,000 lbs. at a speed of 10 miles per hour, placed under control of one engineer and one fireman.

2. A self-contained machine generating the power necessary to develop its hauling capacity. With electric locomotives, where the source of power is separate from the machine which develops the hauling capacity, the first cost of the locomotive alone is, at present, about 50 per cent greater per pound of tractive power developed under working load than for steam locomotives of the 2400 type. To this must be added the greater cost for repairs and operation per mile run for the electric locomotive, and the installation, maintenance and operation of a current producing, conveying, storage, converting and distributing system, which would not be re-

quired by either a steam or an internal combustion locomotive, and all of which increase the capital and operating expenses very materially.

3. A total locomotive weight utilized for the development of tractive power in connection with a running gear, which makes the locomotive suitable for either hauling, pushing or braking freight trains containing the maximum paying load per foot of track space, over level or mountainous railroads of maximum curvature.

4. A maximum tractive power with a minimum rail pressure per driver wheel, on account of the total weight of 334,500 lbs. being distributed over 12 drivers, and a 30 ft. 6 in. total, with a 10-ft. rigid wheel base, resulting in minimum wear and tear on bridges, rails, ties and roadway. With electrical locomotives the excessive weight concentrated on a short, rigid driver-wheel base and below the springs, together with the extremely low center of gravity, results in extraordinary rail pressures, thrusts and wear.

5. The elimination of retard movement and stalling of trains, on account of the usual slipping of driver wheels, as in the case of ordinary simple or compound-cylinder steam locomotives, or with electric locomotives where the driver wheels are uncoupled and the current is naturally transmitted to the point of least resistance, which is the slipping wheels, resulting in no increase of power at the dead wheels. A higher tractive power is obtained to the weight per axle than with the ordinary steam locomotive, as the slipping due to the accumulation of high unbalanced pressure at the points of wheel and rail contact, does not occur at the same time in both engines. When one engine commences to slip a reduction in mean effective pressure follows, and it regains its grip on the rail without making it necessary to shut off or throttle the steam supply. The other engine, meantime, has been gaining power, thus preventing any loss of speed and consequent stalling of the train at a critical moment. These conditions are the same whether the slipping occurs with either the high or the low-pressure engine, and the most frequent cause for stalling with electric or simple cylinder locomotive is thus overcome.

6. A tonnage and speed per train that will provide for the least number of locomotives and crews under the control of which the movement of the business is placed. This will result in the balancing of the power and movement of the maximum number of loaded and empty cars per hour over a single piece of track, with the proper degree of safety.

7. A minimum capital, repair, fuel, engine and crew, oil, supply and displacement cost per locomotive train, car or ton mile.

8. A maximum retarding effect for the safe handling of heavy trains down steep grades at the highest speed permissible for a proper degree of safety.

9. A uniform turning movement to overcome journal friction of axles; rolling and flange friction of wheels; wave resistance of rail; atmospheric friction at ends and sides of rolling stock and inertia of train at time of starting, which will insure the minimum draft gear, machinery and boiler stresses, and reduce the tire and rail wear.

10. A sub-division of power and balancing, resulting in the minimum strains on the locomotive and track, and a reduced liability for wear, breakage or accident. Broken driver-wheel axles on electric locomotives indicate that the more uniform torque does not eliminate the liability for such failures under normal conditions.

11. The minimum amount of dead weight and non-paying load, and the smallest number of bearings and parts per unit of power developed.

12. Ability to move itself and train of one-half rating in the event one set of its machinery or engines becomes disabled.

The speaker admitted that electricity as a motive power is superseding steam in many cases, for suburban passenger and freight traffic, and that it may displace the latter for through passenger service, but thought it would be some time before electrical energy will supplant steam power for the handling of heavy tonnage for any considerable distance. He also thought that their performance, when compared with steam locomotives, shows a cost which makes their present use prohibitive, when fuel must be used to generate power, except in cases of absolute necessity. An electric locomotive complete and crewed, ready for operation, would require: For terminal handling: a running repair shed with drop pit and auxiliary facilities; tracks and switches; inspection pit and sand, repair material and general stores supply. For maintenance: a general repair shop and equipment, and many expensive extra parts for quick repairs and renewals for locomotive and plant. And for line operation: standard gage tracks; sand supply station; power plant building; boilers; draft arrangement; stokers; coal, water and ash intake storage and distributing appliances; coal crushers; superheaters; economizers; feed-water heaters and pumps; condenser equipment; heating, fire protection, compressed air and general and detail lighting systems; engines and generators; exciters; switchboards; piping; oil system; overhead cranes and machine tools; general and auxiliary feeder and distributing systems; transformers; rotary convertors; storage battery; overhead or surface contact lines; bonding; insulation; safety cut-out device; lightning protection device, etc.

On the other hand, a steam locomotive complete and crewed, ready for operation, would require: For terminal handling: a running repair shed with drop pit and auxiliary facilities; tracks and switches; turntable; ash pit; and coal,water, sand, repair material and general stores supply. For maintenance: a general repair shop and equipment, with a few inexpensive parts for locomotive repairs. And for line operation: standard gage tracks, and coal, water and sand supply stations.

After concluding his paper, Mr. Muhlfeld added some general remarks to the effect that while some steam railroads presented attractive opportunities for electrification, particularly those operating in districts where fuel or water power is cheap, electricity could not be expected to supersede steam until the promised performances of electric locomotives were forthcoming. All of the present electric locomotives were of different types. The steam locomotive was capable of handling any reasonable load but, in some instances, the installation of electric locomotives would perhaps be justified because they would increase the capacity of the line on account of their more rapid acceleration. It should be remembered that the initial cost per hp with electricity is much greater than with steam locomotives, and while the extravagant power consumption of the latter was admitted, there were no power station, conversion and transmission losses.

DISCUSSION

The discussion was opened by F. F. Gaines, mechanical engineer of the Philadelphia & Reading Railroad, who said that he could not agree that the use of high steam pressures, like 200 lbs., were economical. In his experience, such high pressures wore out the boiler and other parts, and, in general, is might be said that the cost of repairs was in direct proportion to the pressure used.

Mr. Cole, of the American Locomotive Company, gave some further data on the performances of the Mallet articulated locomotive mentioned by Mr. Muhlfeld.

C. F. Scott, chief electrician of the Westinghouse Electric & Manufacturing Company, called attention to the fact that the B. & O. electric locomotives were being used in a service which could not be properly performed by any steam locomotives; that they represent the first attempt in heavy electric traction, and yet have been doing their work at a cost comparable with that of ordinary steam locomotives; hence Mr. Muhlfeld's comparison in cost of maintenance had been made between the oldest style of electric locomotive and the latest type of steam locomotive, which had not been in operation over a year. Taking up Mr. Muhlfeld's specifications, both mechanical and electrical, in detail, he said that all of the essential mechanical features were embodied in the locomotives which his company was building for the New York, New Haven & Hartford Railroad. As to the electrical electrifications, it was interesting to note in what respects one system of electric operation seemed to meet them better than the other. For example, the requirement that the locomotive should be capable of operation at varied speeds and power. With a d. c. locomotive there are but two economical speeds, one when the motors are in series, and the other when they are in parallel, but with a. c. motors, a transformer can be used furnished with potential taps to give any desired number of speeds. Another point, is the desirability of preventing the independent revolution of wheels coupled in series, this being due principally to the operation of motors in series when at times the first motor takes more power than its share, causing one pair of wheels to slip more and more. With a. c. operation, the motors can always be connected in parallel, thereby giving a condition in which each pair of wheels is held separately. As to returning energy to the line, this can be done easily with alternating current, but with direct current considerable complications would be involved and regeneration possible only at certain speeds. He regretted that Mr. Muhlfeld had not given more particulars about the operating characteristics of the third rail. With a. c. work, a form of overhead construction could be employed far superior to that originally tried by the Baltimore & Ohio Railroad. Other particulars mentioned by the author, such as minimum line conversion and feeder losses, least number of sub-stations, elimination of electrolytic action, etc., are all features secured by the use of alternating-current motors.

H. H. Vaughn, vice-president of the Canadian Pacific Railroad, expressed his belief in the future success of the Mallet engine, especially on account of its low cost. First year repair costs, however, were not fair criterions for judging either electric or steam locomotives. He believed that the development of electric locomotives had not reached its highest point, particularly in hp per ton of metal, and that there was a field for them under certain special conditions as outlined by Mr. Muhlfeld.

Mr. Scott took the floor again, to point out that the greater part of the total maintenance cost of the B. & O. electrical equipment was based on the operation of an old uneconomical type of power plant, low-voltage transmission, involving high-battery losses, etc.—conditions which would not exist in a large modern plant.

W. B. Potter, of the General Electric Company, said that Mr. Muhlfeld's paper had impressed him as an argument for the further development of the electric locomotive. The keynote of the whole situation was that the first requirement by the transportation of the mechanical department, is for locomotives of such capacity and condition as will move the maximum tonnage per foot of track at the greatest speed consistent with safety. Mr. Potter said that it had been well demonstrated that by combining electric locomotives in units, it is possible to secure a more powerful train movement than with steam locomotives. After referring to the fact that the B. & O. locomotives were designed for the special work of hauling heavy trains for short distances, Mr. Potter mentioned the performances of the New York Central electric locomotives, which have been previously reported on in the Street Railway Journal. The low-maintenance costs of other recent General Electric Company locomotives were also given. The criticism made of the low number of hp developed per ton of metal in the electric locomotive, applied only to the old low-speed locomotives. In the New York Central locomotive there were normally 22-hp per ton, but a maximum of 30 hp could be obtained at the highest speed.

WELFARE WORK DISCUSSED BY THE NATIONAL CIVIC FEDERATION

The annual meeting of the New York branch of the National Civic Federation was held at the Park Avenue Hotel Wednesday evening, Feb. 14. Charles A. Moore, chief executive of the New York branch of the Federation, presided.

H. H. Vreeland, chairman of the welfare department of the National Civic Federation, and August Belmont, president of the National Civic Federation, discussed welfare work for street railway companies.

Mr. Vreeland said that one of the methods used to extend the practice of welfare work, which the department has found of especial value, is the holding of conferences of employers under its auspices in different sections of the country for the interchange of experiences. His opinion is that successful welfare work, when pictured by practical business men in connection with the industries, exerts an influence toward gaining the application of similar ideas by other employers. A bureau of exchange is maintained at the headquarters, where literature, plans and photographs relating to welfare work may be obtained by employers. The department also undertakes to supply upon request experts to examine industrial establishments, make suitable recommendations for the introduction of welfare work and, if desired, superintend its installation. For this service the time of the expert is furnished by the Federation without cost to the employer, beyond traveling expenses.

In discussing the welfare work of the New York City Railway Company, Mr. Vreeland said in part: "It has been said that it is impossible to extend the influence of welfare work into the homes of employees in cities. My own experience refutes the assertion. When I installed a library in the club rooms of our Employees' Association, it was my purpose to reach the families. I stated at a meeting where there were 6000 of our employees with their families, that it was the desire of the management that the catalogues of the library should go into the home of every married employee. I made it clear that we wanted the wives and sons and daughters of the employees to read the books. I also announced that if there were a man who had a son and daughter working for an education—technical education, perhaps—and special text-books or books of reference were needed, the books would be bought and put in the library upon application. The library is, so to speak, a family concern, and it was turned over at least twenty-five times the first winter we had it. It was astonishing, too, to see the high grade of literature that was taken out.

"Our Relief Association provides for a man in case of illness or accident, a pension in old age and at the time of death, a fund for burial. I have found that the wife of the average laboring man will always land on her feet, if she is tided over for a few weeks, when the husband dies suddenly. All these benefits lead us into the home life again.

"My own experience as a wage earner having taught me that the unmarried man has no place to go evenings, except a hall bedroom, cold in winter, led me to establish club rooms for the men employed on the street railways in New York City. A large percentage of the ten thousand men employed by our company live in boarding houses. Many are from the country. Thirty years ago, as a brakeman on a steam railway, I was in the same position, away from home and forced to live in a boarding house, such as the railroad terminals and my wages could afford. There was absolutely no place for me in the evenings, where it was warm, except the saloon and the pool room. I said to myself, 'Here my own experience shows me something our men need.' The club rooms we established include an auditorium, where monthly entertainments are given, a library, a pool room, and a physician's office. They were used immediately and extensively, and a chance visitor will find the rooms filled every night in the week.

"It is, of course, impossible in a large city, where the employees live in widely distributed districts, to promote frequent evening entertainments, but the plan of taking a large hall, which is pursued by many large employers in New York and other cities, for an annual entertainment or ball, has become quite customary. These entertainments are much enjoyed by the employees, their sweethearts and families. In my own experience, I have never been able to secure a hall large enough to accommodate all who desire to attend.

"At our annual entertainment the president of the company, who is also president of the Employees' Association, reports upon the financial status of the work of that organization. We always arrange to have the best features from the different vaudeville entertainments in the city on that occasion."

Mr. Vreeland then made a general statement on welfare work, in which he said: "All of the welfare activities which apply to the sanitary conditions of the work places are applicable alike to the mill village and to the city. An employer who is noted among his employees for fair dealing, need have no fear of introducing welfare work after a careful study of conditions have been made. That is to say, after recognizing the first needs of the employees to be steady work, an equitable wage and hours as short as competitive conditions will permit, the employer may successfully install welfare work, if the proper attention is given to its introduction. All of our investigations of failures in this line have shown us conclusively that a just and fair policy of dealing with labor must be the foundation for all welfare work. With that foundation, it may be emphatically stated that employees will welcome all such efforts to provide for their welfare. Through welfare work we find re-established the personal touch between the employer and employees, which was lost when commercial organizations grew to such vast proportions. The welfare work establishes a bond of sympathy, because these efforts to provide for the comfort of employees indicate to them that the employer is interested in their welfare. While the employer cannot, under present conditions, meet individually each employee, he can periodically attend their functions, and this active participation of the employer not only brings him into communication with the employees but it is highly appreciated by them, and is essential to the successful prosecution of welfare work."

August Belmont was the last speaker of the evening. He said in part: "My interest in the subject before you to-night was such as to impel me to disobey my doctor's instructions, for he had told me to remain at home.

"Before leaving I want to say that the subject of welfare work has the closest attention of the Interborough Company. A complete method of insurance was worked out by experts in the company's employ on lines similar to those in use on the Pennsylvania Railroad and submitted to our men. For some reason they saw fit to reject it.

"We conferred long before there was any thought of our interests becoming identified with the New York City Railway officials on the subject of welfare work, and we are only waiting now for the return of our vice-president to inaugurate our own welfare department.

"In addition, although it has probably escaped you because of other aspects in which the association of traction interests —I won't say merger, for it is really but the association of the interests of the stockholders—the new corporation proposes to interest itself to a very large extent in the matter of suburban homes, and a subscription of a seriously substantial sum has been arranged for, to the end that such of its men as desire may avail themselves of comfortable homes."

It was determined at the meeting to enter thoroughly into the sphere of welfare work, and to this end a resolution was adopted, providing for the appointment of a committee to be composed of employers, labor representatives, and representatives of the general public, to confer with the welfare department of the National Civic Federation, as well as subcommittees, to give consideration to improving the condition of employees in New York City and in the different trades in the vicinity.

MONTHLY TRAIN RECORDS OF DELAYS

The Columbus, London & Springfield Railway Company has been keeping for some time monthly records of all train delays, and the following shows the statement for the month of January, 1906. It was not selected as a remarkable record in any way, but as illustrating the method followed and as a typical monthly report. The limited cars referred to in the report have now been discontinued on account of deficiency of power, and on this account the company never claimed to operate them as regularly as the rest of the service.

TRAIN RECORD ON THE COLUMBUS, LONDON & SPRINGFIELD FOR JANUARY, 1906.

NO. OF TRAINS.	LIMITED.	LOCAL.	FREIGHT.	TOTAL.	TOTAL CAR HRS.
Scheduled	72	1170	130	1372	3114.22
Annulled	8			8	16.00
Run	64	1170	130	1364	3098.22

NO. OF DELAYS CAUSED BY ORIGINAL FAULT IN	LIMITED.	NO. OF TRAINS DELAYED.	MINUTES EACH TRAIN DELAYED.	TOTAL HRS.
Power	1	3	15, 15, 15,	.45
Track	1	1	8	.08
Wire				
'Phone				
Car	4	4	18, 35, 9, 15,	1.17
Derailment	1	1	10	.10
Collision				
Sleet on Trolley				
Slippery Track				
Deep Snow				
Heavy Travel	2	2	9, 6,	.15
Total	9	11		2.35
NO. OF DELAYS CAUSED BY OTHER COMPANIES OR PERSONS.				
Connections late	2	2	15, 18,	.33
Other Car Derailed	3	4	15, 15, 20, 30,	1.20
R. R. CROSSINGS				
H. V.	1	1	10,	.10
B. & O.			7, 7, 15, 20,	
Big Four, Col's.			13, 8, 12, 15, 5, 11,	
Penn., W. Jeff.			5, 15, 12, 18, 13, 20,	
Big Four, Springfield	14	22	20, 20, 14, 16, 11, 18,	4.58
Total	20	29		7.01
Grand Total	29	40		9.36

On January 8th deep snow (storm), all west bound trains running from ten to thirty-five minutes late; east bound trains running from ten minutes to one hour late. Heavy load on station, power bad.

4 Limited trains annulled on account of defective cars.

4 Limited trains annulled on account of deep snow (storm).

THE MANAGEMENT AND EQUIPMENT OF PLEASURE RESORTS

The park idea has taken so firm a hold upon electric railway companies that its feasibility in most instances has long ceased to be a question, and the principal considerations have become those relating to operation and equipment. There are still quite a number of railway companies, especially those serving territory of great scenic beauty, which regard the park business solely as a profitable method for increasing the passenger traffic and do not attempt to make the park a paying investment in itself. Experience in many quarters, however, has shown that it is worth while to treat the park question as something more than a secondary matter. Of course, there are many railway companies whose possible development of park business would not prove big enough to warrant the employment of an amusement specialist, yet even these companies can increase their income from this source by learning what kind of attractions have succeeded in other places and under what conditions they have been presented.

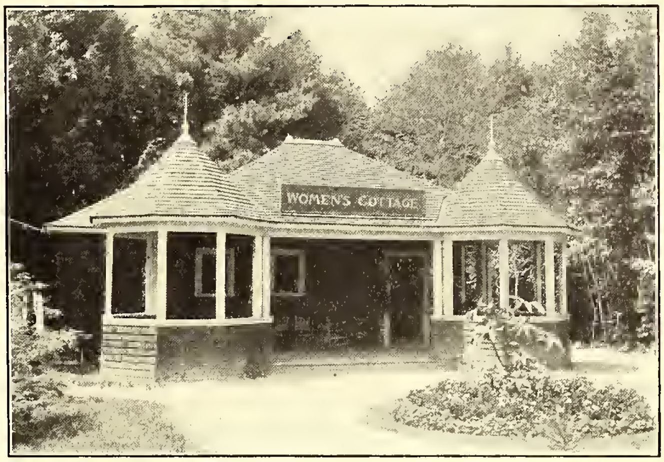
ROLLER SKATING RINKS

One of the most remarkable features of the last season was the great revival of roller skating rinks. Emboldened by the success of the few who had by proper management successfully revived this pastime the year before, several other rinks were erected along the same lines of management and operated with considerable profit. It can hardly be doubted that the coming season will witness a large increase in the number of skating rinks, and that they will meet with financial success, provided they are operated so as to keep out all rowdy elements and at rental rates which will encourage the majority to take advantage of this splendid recreation. Through the courtesy of several railway companies which have installed rinks, it is possible to give here the methods they pursued in presenting this feature and the results secured.

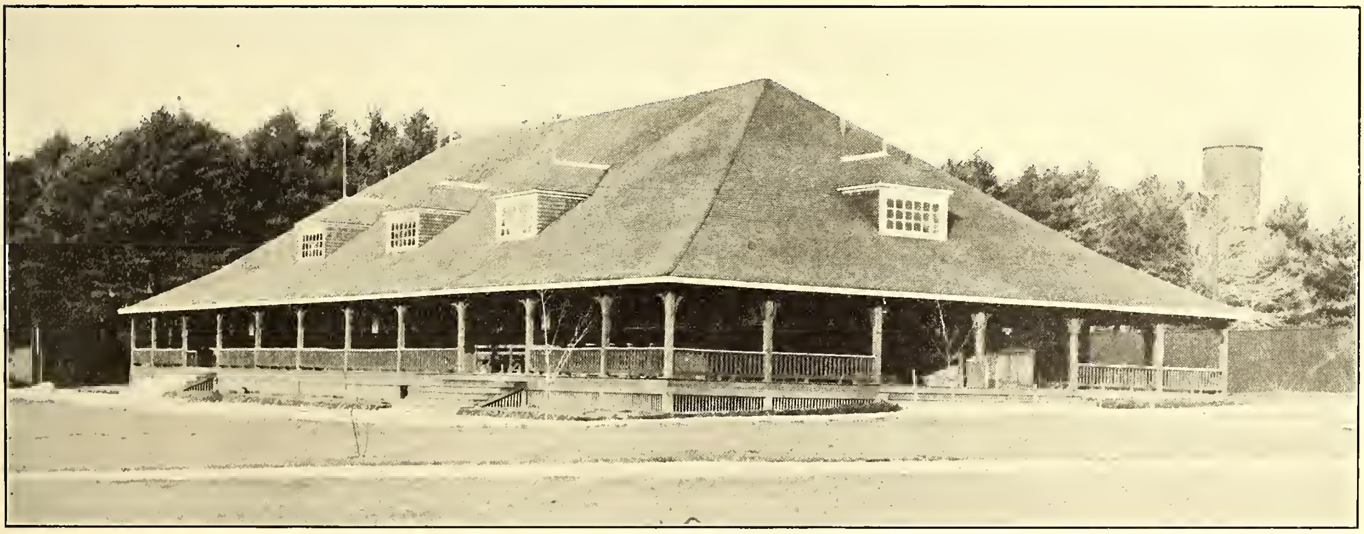
Among the railway systems which took up roller skating during the past season is the New Hampshire Electric Railways, which erected a rink at its famous summer resort, Canobie Lake Park, located at Salem, N. H., 10⅓ miles from Haverhill, Mass., 8½ miles from Lawrence, Mass., 15 miles from Lowell, Mass., and 16 1-5 miles from Nashua, N. H. The park contains 50 acres of land and is situated on the shore of Canobie Lake. Among the attractions here are a large open-air theatre seating 3000 people; a figure-eight roller coaster; merry-go-round; box-ball alleys; shooting gallery; photograph gallery; boat house and wharf, where a large number of boats and canoes are let, besides two large naphtha launches, which make frequent trips around the lake; a large restaurant seating 500 people, and offering a cuisine and service said to be unsurpassed by the best hotels in the country; a small restaurant containing a lunch counter, pop-corn stand, candy souvenirs, etc.; extensive dance hall; penny arcade; and a rink structure 146 ft. long and 70 ft. wide, with a skating space of 126 ft. x 50 ft. All of the privileges in the park, with the exception of the theatre, are let on a percentage basis. There is also an athletic ground, with seats for 3000 people, where baseball games are played and free, open-air exhibitions given, such as high-wire, diving horses, balloon ascensions, wild animals and fireworks. Within the grounds there is a large picnic grove set apart for outings by particular churches or other organizations. With reference to the roller skating rink, which was equipped with skates made by the Union Hardware Company, of Torrington, Conn., and the Samuel Winslow Skate Manufacturing Company, of Worcester, Mass., the company found it to be a good drawing card in connection with the other park attractions, and it was liberally patronized during the entire season. The charge for admission, including the use of skates, was 25 cents. The parties operating this atttraction had a force of gentlemanly attendants, and the rink was managed in a first-class manner in every respect, thereby insuring the continued patronage of the best classes of people. It is expected that the patronage of this feature will be even greater during the coming season. The success of roller skat-

A GROUP OF BUILDINGS IN CANOBIE LAKE PARK, OWNED BY THE NEW HAMPSHIRE ELECTRIC RAILWAYS COMPANY ing is particularly noticeable on account of the numerous high-class attractions with which it had to compete, and this fact, taken in connection with the success of the same feature under widely different conditions in other places, shows that roller skating appeals favorably to all classes of people. It might be added here, that other park managements could imitate with profit the neat style of architecture shown in the accompanying views of Canobie Park buildings.

One of the first railway parks where roller skating was revived is Bushkill Park, a prominent pleasure resort near Easton, Pa., along the line of the Northampton Traction Company. It was very much of an experiment on the company's part to find out whether the people were ready for this amusement or not. The company built a pavilion that cost nearly $10,000. It is 230 ft. long, 80 ft. wide and has a hard maple floor. The pavilion is enclosed in glass in sash form, which can be taken out intact, and the sides are in regular panels which are used for tables in the park. The first skates used were of the Winslow wooden, ball-bearing, roller type. This year the company has disposed of all the wooden rollers and put in Winslow ball-bearing, web-steel rollers. These latter skates have been found more durable than anything else, and the patrons greatly prefer them. No admission is charged to the rink itself, and only 10 cents for the use of the skates. As the park is within the 5-cent fare limit, the sport is placed within the means of the poorest, and has become very popular. The building is operated as a roller skating rink from the middle of October to the middle of May, but for the rest of the year is run as a dancing pavilion. By this combination the park has become a source of profitable income all the year round. This rotation was introduced because the patrons are also very fond of dancing, and prefer it during the hot weather. Further north, of course, the skating period could be extended. During the skating season the management presents numerous attractions such as fancy and trick skaters, and one and two-mile races once a week with local people. There are fancy-dress carnivals about every four weeks, upon which occasions small prizes in money or roller skates are offered, as the company has found that this practice does very much toward keeping up the interest of the people in this amusement. The building has held as many as 1400 people in one evening, which has convinced the management that it would have been a great mistake not to have installed roller skating, for in that event the pavilion would have lain idle seven months in the year. There is another economical side to the question of roller skating that appeals to the Northampton Traction Company, namely, that since the park buildings are cared for and watched all the year round, they remain uninjured and do not become dilapidated. During the winter the pavilion is heated with stoves, and when spring comes it will be in practically as good condition as it was in the fall. The company's experience so far has been that the skating receipts have taken care of all the expenses of operating the park and the rink this winter, leaving all of the fares of the passengers to and from the park as additional revenue to the railway.



TWO TYPES OF THE ARTISTIC STRUCTURES INSTALLED IN CANOBIE LAKE PARK



A VIEW OF THE SKATING RINK AT CANOBIE LAKE PARK

The Virginia Passenger & Power Company, of Richmond, Va., has also had some interesting results with roller skating. The company has under its control a large horse show building with a seating capacity of about 4000 people, and an oval exhibition ring 190 ft. x 70 ft. Last spring this was floored over and a skating rink opened. It ran very successfully during the summer. The floor was removed for the Horse Show in the fall, but was replaced later, and the rink has been operated successfully since the close of the Horse Show with Winslow skates. Novel features, which General Manager Huff introduced in conjunction with the skating rink, are band concerts and moving pictures, the latter being presented while the skating is in progress.

INTERIOR OF THE BUSHKILL PARK SKATING RINK

One important point of the roller skate question must not be overloked, namely, the skate itself. Convenient and cheap transportation, a handsome pavilion, polite attendants and elimination of all tendency to rowdyism, are all necessary factors toward success, but their good effect is nullified if the skates are hard running or liable to breakage on account of flimsy construction. Therefore, it behooves the rink manager to investigate carefully before purchasing the hundreds of pairs required.

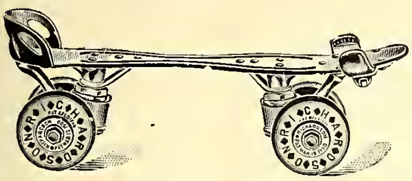
The skates made by the Union Hardware Company, of Torrington, Conn., are being used to a very considerable extent by the railway park managers and, in particular, the following companies may be mentioned: The Consolidated Railway, Light & Power Company, of Wilmington, N. C.; the New Hampshire Electric Railways, of Haverhill, Mass.; the Lexington & Boston Street Railway Company, of Lexington, Mass., and the Nahant & Lynn Street Railway Company, of Lynn, Mass. As a great number of rinks are let to private parties who purchased their equipment through the hardware dealers, it is rather difficult to say just how many railways are using these, or other, skates, but the foregoing list shows how quickly the revival has taken hold. One of the illustrations on page 315 shows the company's men's roller skate No. 15. These skates are supplied for both men and women with either hemacite or steel rolls, as may be desired when ball-bearing models are used, and with hemacite or lignum-vitae rolls when plain bearing skates are employed.

Another type which has been giving satisfaction, as already noted in the description of the Bushkill Park and Richmond rinks, is the Winslow ball-bearing skate with web-steel rolls. Among the principal features of this line are the following: A web-steel, ball-bearing roll; a rubber-adjusting mechanism which permits, if desired, the shortest possible turning; and a novel bridge truss reinforcement beneath the foot-plate to prevent any springing or bending of the plates. The latest type of skate made by this company, No. 17 or 1906 model, is shown in an illustration on page 315. The Pittsburg Railways Company is also using a large number of these skates. A remarkably large skating pavilion is the Park Square rink in Boston, for which over 5000 pairs have been furnished.

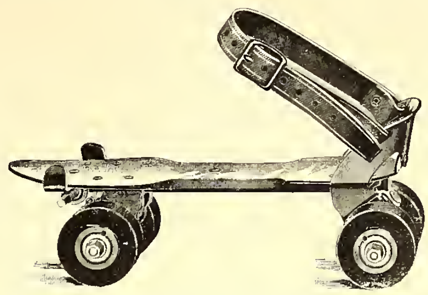
THE MERRY-GO-ROUND IN CANOBIE LAKE PARK

A VIEW OF THE EXTERIOR OF THE SKATING RINK IN BUSHKILL PARK

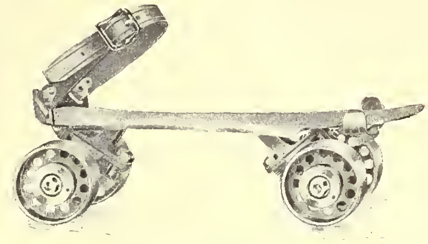
The Richardson Ball-Bearing Skate Company, Chicago, also report a most phenomenal boom in roller skating throughout the country, and the present demand for these skates exceeds that of any previous period during the past twenty years, and notwithstanding the fact that the company is manufacturing from five to six hundred pairs of skates daily, some difficulty is experienced in filling orders. Over seventy thousand pairs of these skates have been sold during the past year, and they are used exclusively in many of the prominent rinks of the country, including Mechanics' Pavilion, San Francisco, Cal.; Music Hall Roller Rink, Cincinnati, Ohio; Delmar Skating Academy, St. Louis, Mo.; Princess Skating Rink, Louisville, Ky.; Westport Palace Skating Rink, Baltimore, Md.; Convention Hall, Kansas City; Royal Rink, Cleveland; Wayne & Washington Rinks, Detroit; Casino Rink, Minneapolis; Auditorium, Omaha; Coliseum, Chicago; also the Auditorium Rink, Columbus, Ohio.



RICHARDSON RINK SKATE WITH RUBBER CUSHION

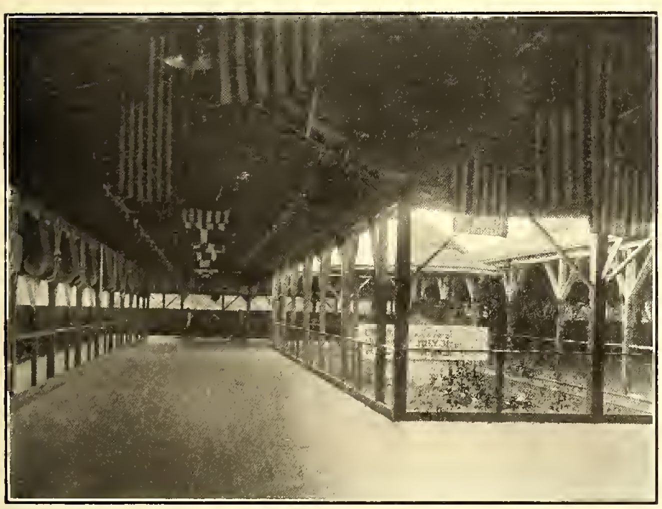


UNION HARDWARE SKATE FOR RINK USE



WINSLOW RINK SKATE WITH WEB STEEL ROLLS

A view of Manhattan Beach Park, Denver, Col., is reproduced herewith. The construction of this building is novel and especially desirable for open-air skating rinks. The structure is about 180 ft. long, 85 ft. wide, with an open center of 25 ft. The covered track on each side is 20 ft., the promenade on each side 10 ft., and the tracks on the ends 35 ft. The structure cost about $4,500. Considering the fact that skates are not now used to any extent for sidewalk skating, and only the highest grade ball-bearing skates are manufactured by the company, the great sales above mentioned indicate very clearly the popularity of roller skating throughout the country; in fact, it is estimated that there are from twelve to fifteen hundred flourishing rinks in America at the present time, and the number is increasing daily. The mechanical construction of the Richardson skate embodies great simplicity. One of the most essential features is that which provides for a large rubber cushion on which the skater rides, and which eliminates all jar and vibration. The foot-plates are framed up from the finest cold-rolled steel, corrugated and otherwise reinforced to assure great strength. Every foot-plate is guaranteed against breaking for one year. The bearings are turned from first quality machinery steel, case hardened and polished, every part being interchangeable. Steel, aluminum and wood fibre rollers are furnished on regular rink skates, and boxwood or aluminum on racers. As regards the Richardson Racer, the company claims to have held every world's record since 1884.



SKATING RINK INSTALLED AT MANHATTAN BEACH PARK, DENVER, COL.

PENNY ARCADES AND SLOT MACHINES

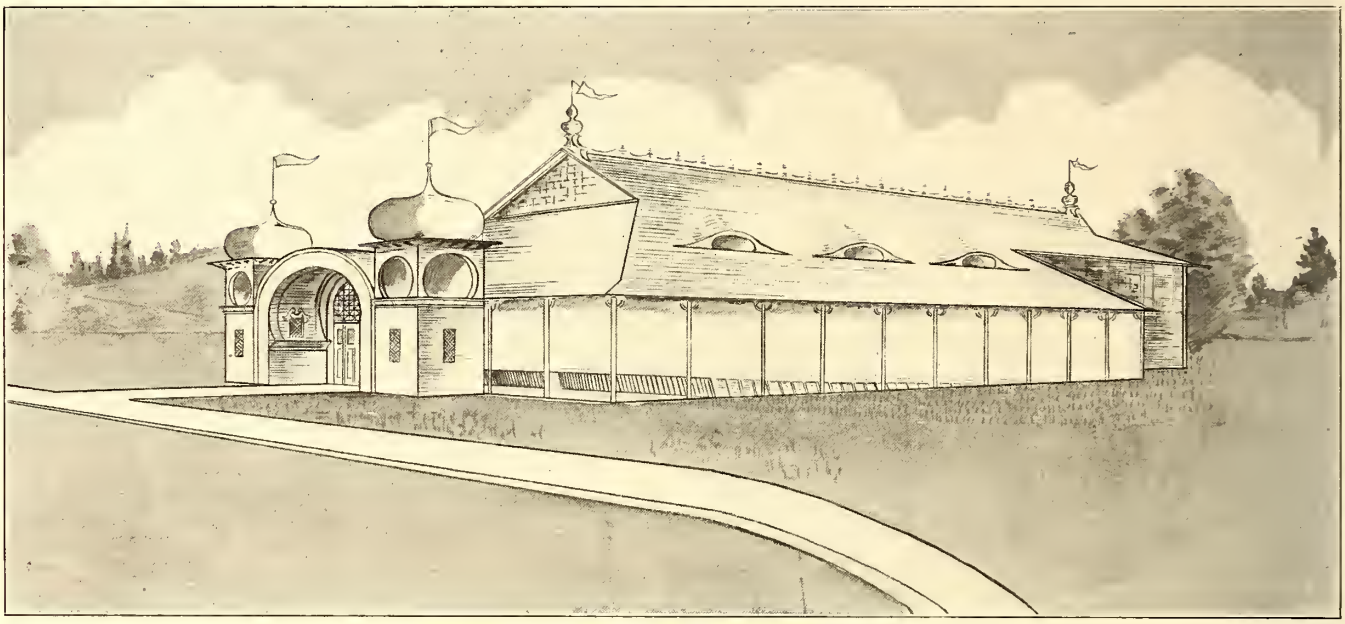
Not so long ago the idea of grouping in one place a number of penny-in-the-slot machines was not thought of by their owners. The weighing machines, scales, gum vendors, etc., were usually scattered throughout the park, no special attempt being made to encourage their use. In fact, slot machines were not supposed to be worth any more attention than that incident to collecting the accumulated coins and replenishing the stock. Naturally enough, the isolated situations of these machines often resulted in their being tampered with to such an extent that in a short time they would be in very bad condition and fail to work at all, much to the chagrin of the would-be customer, who thereupon resolved to steer clear of what he termed "bunco" devices. However, the later developments in slot contrivances of more expensive and entertaining character, such as mutoscopes, phonographs, punching and lung-testing machines, soon demonstrated that the best results could be secured only by placing all of the machines under cover in one building and in the care of capable attendants. Thus began what are now known as "Penny Arcades." These arcades have proven so popular and profitable both in the city and country, that it is well worth while to study the practices of those who have achieved success in this field.

Where the penny arcade is intended as a railway park attraction, the machines should be placed in a tastefully designed building, open nearly all the way round, with passages so arranged that patrons entering one place can make use of the various slot devices and then leave the building without being obliged to turn around and interfere with later comers. By constructing the building with an overhanging roof, an excellent shelter is provided for protection from summer rain storms, on which occasion the public is sure to patronize the machines more than ever. The building can also be used during cold weather by adapting the outer framework for the reception of glass or other panels. A corner of the building should be reserved for storage and repairs.

The first requisite in the success of penny arcade operation is the reliability of the machines. Nothing can be more injurious than to have a patron fail to get the proper return for his money. For this reason, a competent mechanic should go over all of the machines from time to time to keep them in trim, but when a customer does find it necessary to complain of the failure of some device, the cashier should refund his money without question. The second requisite is cleanliness, a very important matter in any place which is frequented by all classes and conditions of people. The floors should always be kept as free as possible from dirt, cigar and cigarette stubs, papers, etc., so that the ladies will not suffer the annoyance of soiling their skirts whenever they wish to patronize the arcade. All of the various devices should also be kept well painted or polished, the phonograph ear-pieces cleaned frequently, etc. The third requisite, is to keep the attraction new. No hesitation should be felt in spending the little extra money required for new phonograph records or mutoscope reels, as the public cannot be expected to pay for listening to the same songs or seeing the same pictures day after day. The manufacturers of these devices are only too glad to co-operate in this respect by making only nominal charges whenever desired to exchange reels or purchase records. For instance, the American Mutoscope & Biograph Company, of New York, charges but three cents a day for changing its mutoscope pictures, which number over 5000 subjects. The fourth requisite, is to secure all the money entering the machines. Even if an arcade is improperly operated, it would show a profit were it not for the ease with which dishonest employees can rob the machines. It is therefore wise to have the cash collected only by bonded employees who are known to be trustworthy.

It is hardly necessary to add that the moral tone of an arcade should be such that none of the attractions offered will offend anyone's susceptibilities. Some of the machines using stereoscopic pictures have been of such objectionable character as to disgust the majority of the patrons, but this has never been true of mutoscope photographs, and the park manager has the choice of thousands of high-class attractions from which he can select whatever is most likely to appeal to his patrons. Because the revenue comes in one-cent pieces instead of quarter or half-dollars, the park manager must not assume that the penny arcade will not give a better return on the investment than many other attractions which require an outlay amounting to thousands of dollars. In fact, the first cost of the machines is so small that it usually is much more profitable to buy them outright than to rent them from the manufacturers. While no one company makes all of the slot machines needed for a first-class arcade, the rapid increase in the popularity of this feature has given the manufacturers of these devices all that they can do. The park manager, therefore, should not delay his preparations for the coming season until the warm weather begins.

Another example of the success of penny arcades in high-class resorts is afforded by Norumbega Park, which is operated by the Boston Suburban Electric Companies. It is stated by Matthew C. Brush, vice-president and general manager of the company, that this particular feature of the park was such a marked success that last year the management doubled the size of the building, and the results for the past season were such as to fully warrant it in this move. In this building there is a souvenir counter, at which souvenirs are sold; there are also in this building all kinds, classes and descriptions of penny-in-the-slot machines; a Japanese bowling alley; a penny-in-the-slot target device; an arc-light photograph device, etc. The floor space of the building is divided in such a way as to facilitate the handling of a very large crowd. A special effort was made to see that the building was especially attractive both inside and out, and in the endeavor to accomplish this, incandescent lights were placed around the edge of the roof of the entire building, and in the center of the building, inside, a fountain with running water and electric lights, the base of the fountain being approximately 12 ft. in diameter. The management has found that it has no particular feature in the park which is more remunerative and apparently more appreciated by the public. It conducts the same on a very clean policy, being especially particular in regard to the class of pictures, etc., shown in the slot machines. Experience leads the management to believe that the more machines one can place in the building the more will be the returns, as there are apparently a number of cases where patrons will try each and every machine. It has also been found advisable to change the views, music, etc., rather often, as the park is largely patronized by regular patrons each week. Everything in this penny arcade or chalet is operated on a percentage basis, the lessee furnishing the material or device, with the exception of the souvenir counter, which is run by the management.

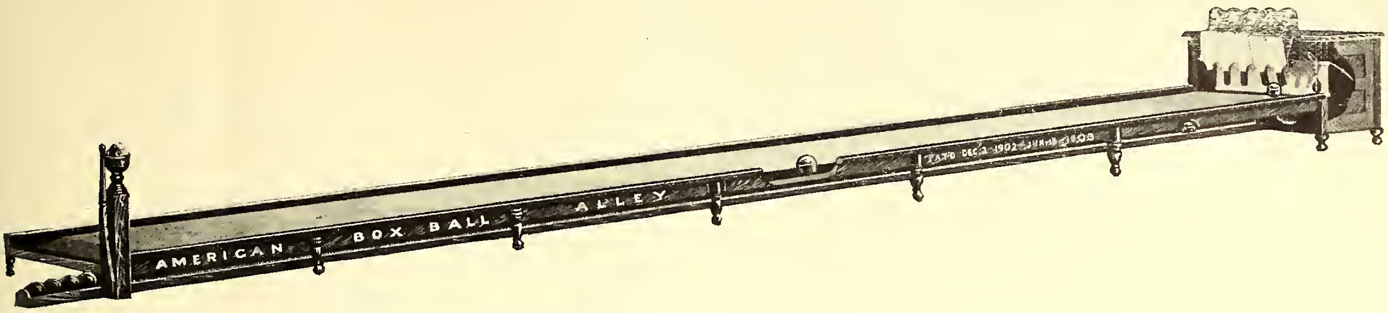


A TYPICAL SUMMER THEATER, INSTALLED FOR A SMALL RAILWAY PARK

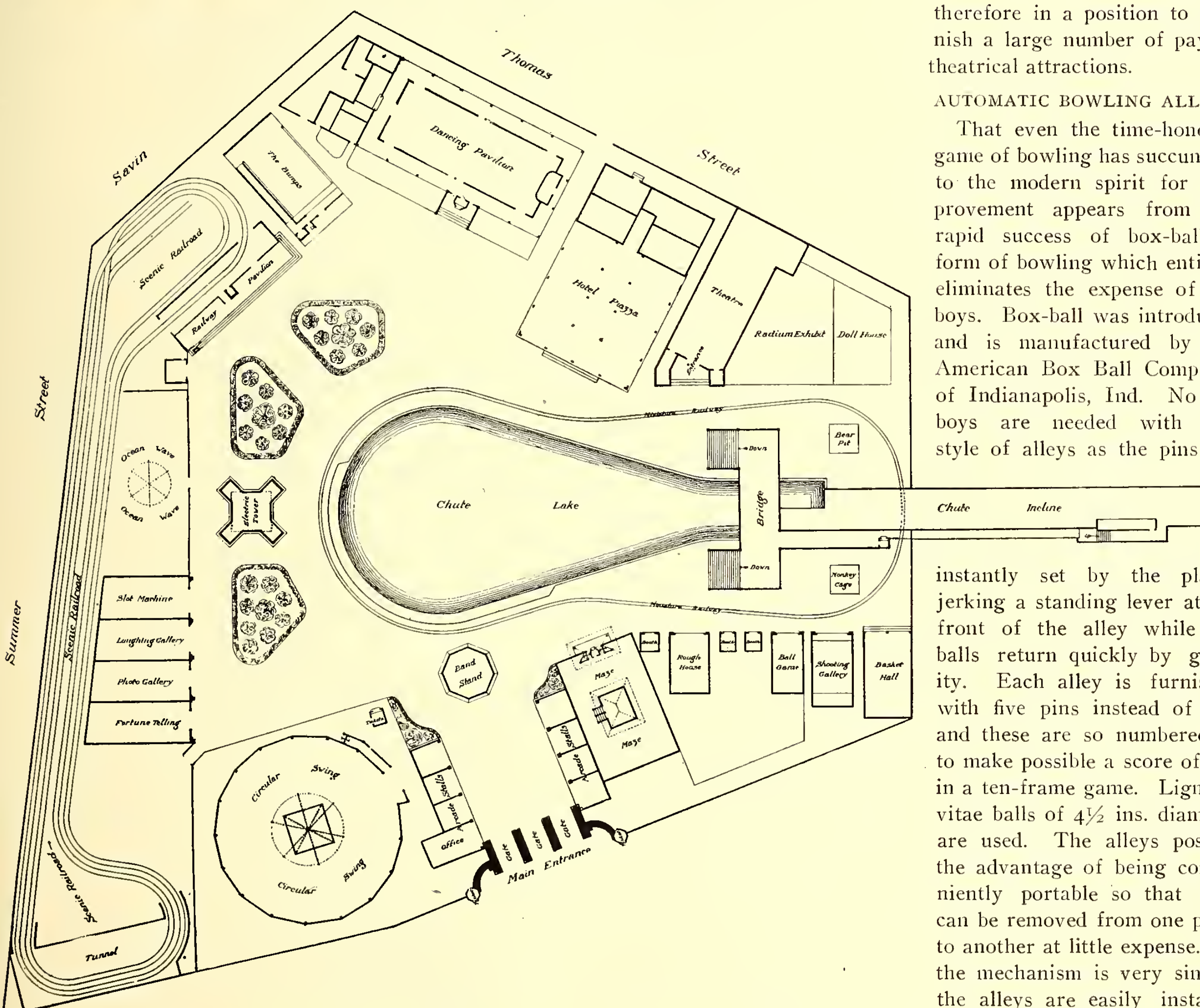
THE PLANNING OF AMUSEMENT BUILDINGS AND SPECIAL SHOW STRUCTURES

The number and variety of structures needed even in a park of ordinary size is such that their proper construction requires a great deal of experience in this class of work. To lighten the park manager's problems in this respect, the well-known park builder, Ed. C. Boyce, Inc., of New York, is prepared to sell detail plans of such features as figure-eight roller-coasters, "Bump the Bumps," "Canals of Venice," "Great Coal Mine," etc., which can then be erected on the grounds by any ordinary carpenters and mechanics, the designer also furnishing any special material that may be needed. This plan of making designs to suit the local conditions combines the advantages of economy with this corporation's varied experience in the summer amusement field tends to insure a reliability in service which might otherwise be unattainable.

The design of summer park theaters has long been a specialty with J. W. Gorman, of Boston, Mass. The accompanying illustration on page 316 shows one of his designs for which he has prepared detail construction drawings. As the result of his long experience in this field Mr. Gorman has arrived at the conclusion that, while a big park with varied attractions is the best proposition where the population is large, a summer theater involving a small initial outlay and low running expenses will prove much better as an investment in moderately populated territory, if good attractions are secured and there is a weekly change of bill. Mr. Gorman controls an extensive circuit of summer parks, and is therefore in a position to furnish a large number of paying theatrical attractions.



A COMPLETE BOX BALL ALLEY



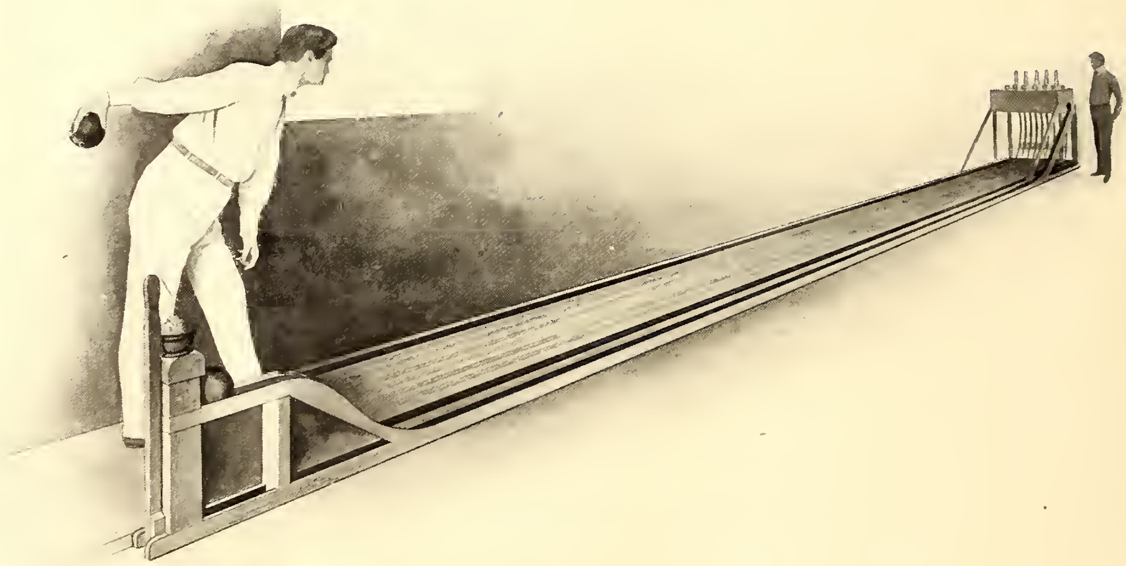
LAYOUT OF THE AMUSEMENT PARK AT SAVIN ROCK, NEW HAVEN, CONN.

AUTOMATIC BOWLING ALLEYS

That even the time-honored game of bowling has succumbed to the modern spirit for improvement appears from the rapid success of box-ball, a form of bowling which entirely eliminates the expense of pin boys. Box-ball was introduced and is manufactured by the American Box Ball Company, of Indianapolis, Ind. No pin boys are needed with this style of alleys as the pins are instantly set by the player jerking a standing lever at the front of the alley while the balls return quickly by gravity. Each alley is furnished with five pins instead of ten, and these are so numbered as to make possible a score of 300 in a ten-frame game. Lignum-vitae balls of 4½ ins. diameter are used. The alleys possess the advantage of being conveniently portable so that they can be removed from one place to another at little expense. As the mechanism is very simple, the alleys are easily installed in a couple of hours, and once in place are maintained at small expense. The remarkable popularity of this form of bowling is apparent from the manufacturer's statement that over 3000 alleys have been sold since the first one was made about three years ago. About 50 parks were equipped last year, and the company already has orders for the season of 1906. Figures submitted by users of box-ball alleys show that this sport is even more popular than the game of ten pins, and, of course, is far more profitable to the operator of the alley since the only labor expense is that for the cashier, who can also act as general supervisor and caretaker.

The Matthews-Fahl Company, of St. Louis, has also achieved successful results with its ingenious boy-less bowling alley, and recently has perfected several designs especially serviceable for park use. One of these, which is a double alley, was described and illustrated in the Street Railway Journal of Sept. 23, 1905. The accompanying illustration shows this company's new, single-cork alley, intended for fast playing. Its construction is such as to increase greatly the possible number of games played within a given period, thereby producing more revenue to the operator. Another feature that reduces the time of playing is the fact that a "strike" or a "spare" can be made as in regular bowling.

THE BOX-BALL ALLEY IN OPERATION



THE BOY-LESS BOWLING ALLEY

TOBOGGAN SLIDES, RIDING GALLERIES, ETC.

The work of the Philadelphia Toboggan Company, of Philadelphia, is the construction of forest coasters, toboggan slides, carousels and similar amusements for summer parks. It has equipped a large number of resorts throughout the country, and the neat, artistic character of its structures are well shown by the reproductions on page 319 of portions of a park in Columbus, Ohio, and another at Chestnut Hill, Philadelphia. Among other towns containing parks with profitable features recently furnished by this company are New Orleans, Milwaukee, Denver, Norfolk and Topeka. The toboggan slides and roller coasters made by this concern are laid out on the best engineering principles to insure safe operation, but they are also designed with an eye to their enhancing the appearance of the park itself. The carousels are made to keep pace with the excellence of the company's other productions, both the orchestrions and animals being the work of high-class artisans.

The world-wide popularity of the merry-go-round is attested by the installations of the Herschell-Spillman Company, of North Tonawanda, N. Y., which are to be found in numerous parks in the United States, Mexico, Brazil and other countries. The accompanying view of a merry-go-round in Mexico shows how popular this amusement is across the southern border. The variety of the company's machines is so great as to make detailed descriptions impracticable, but the company will build these devices in any desired size and degree of elaboration. Lately the company has brought out some other amusement devices, such as the "House-Front Doll-Rack," containing comic heads to be knocked back by baseballs; the "African Dodger," which serves the same purpose as the doll-rack, except that the opening is for one head only, which is placed in an imitation tree trunk on a canvas depicting a watermelon patch; and the "Old Woman," a substantial figure, arranged to swing like a pendulum while the patron endeavors to break a pipe in her mouth with the little shillalah" supplied with the equipment. The company also builds striking machines, miniature railways, as will be mentioned later, under the special heading of "Miniature Railways," "Ocean Waves," Ferris Wheels, and other attractions.

Another builder of park structures is the Franklin Toboggan Company, of Philadelphia, Pa., which has recently brought out three new toboggan slide designs. The first of these is known as the "Clover Leaf," and as the name implies, this structure is built in the shape of a clover leaf. The ground required for the same is about 150 ft. x 225 ft. It is claimed that it cannot be excelled as a profitable drawing-card. The structural lumber used is the very best long-leaf Georgia pine, and all joints are strongly bolted together. The slide is equipped with safety devices to prevent danger. The pavilion is designed in old colonial style and is about 35 ft. x 74 ft. deep. It covers entirely the loading and unloading platform, also the main entrance, ticket booth and manager's office. A 30-hp motor or steam engine is used to carry the handsomely carved and richly upholstered cars up to the top of the incline, from which point they run along on a hard maple track by gravity, smoothly and easily. From the highest point of the toboggan the cars wind their way around the clover-leaf figure, crossing and recrossing until they have made the trip three times, arriving at last under the brake-shed, where they are gradually brought to a stop. The ground covered by the second design, or racing toboggan slide, is 100 ft. wide by 250 ft. deep. This toboggan is built in the shape of an oval, and consists of a double track. It is a very exhilarating and most exciting ride from start to finish. Two cars are run parallel to each other in the same direction, one fast and the other slow (similar to racing horses), thereby adding greatly to the amusement of the occupants of the cars. The track is so constructed that the cars arrive at the terminal at the same

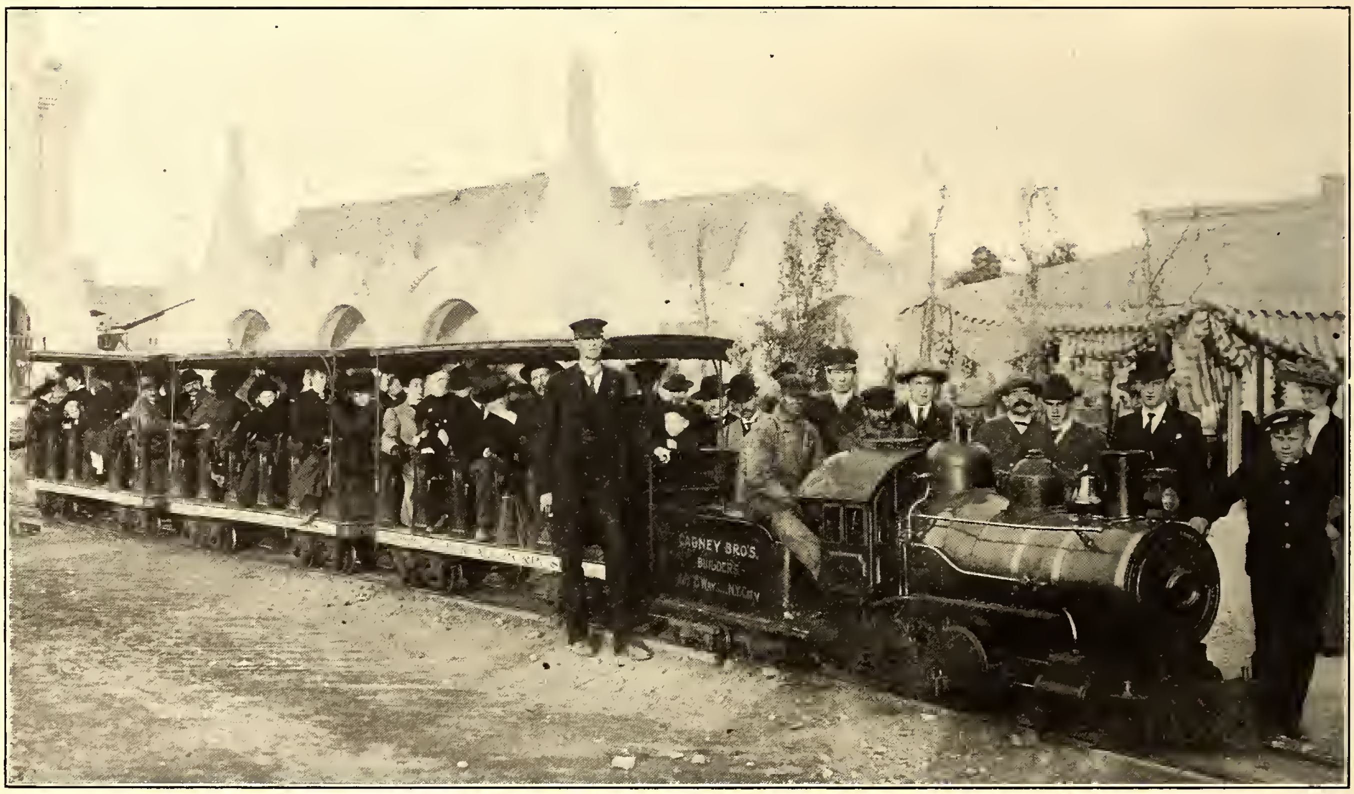
VIEW OF ONE OF THE FINE STRUCTURES IN A PARK AT COLUMBUS, OHIO

AN ORDINARY CROWD AT A MERRY-GO-ROUND IN MEXICO

A HANDSOME GROUP OF PARK BUILDINGS AT CHESTNUT HILL, PHILADELPHIA. A ROLLER COASTER IS SHOWN IN THE BACKGROUND time. The third design, or portable toboggan slide, is especially constructed for street railway parks, county fairs, carnivals, etc. The ground required for the structure is 60 ft. x 110 ft. All structural parts are connected by means of bolts and screws only, and it requires seven to eight hours to erect complete such a machine. Two railroad box cars are ample for transporting the whole structure, including six to seven toboggan cars. In other respects the construction is about the same as for permanent toboggan slides. A 15-hp motor, steam or gasoline engine is used to carry the cars to the top of the incline.

MINIATURE RAILWAYS

When an amusement feature has become so fixed in popularity as the miniature railway, it hardly seems necessary to go into any details regarding its construction. It suffices to state that it has been found a good money-maker in many parks where it serves not only for the gratification of the children, but also for the older folks who like to take a pleasant ride about the grounds. It has been found in quite a number of amusement resorts that additional attraction can be given to the miniature railway feature by the construction of tunnels, the placing of imitation boulders along the route, etc., the variety and amount of this kind of work depending, of course, on the character of the park land.



A MINIATURE RAILWAY IN ACTIVE SERVICE DURING THE LOUISIANA PURCHASE EXPOSITON

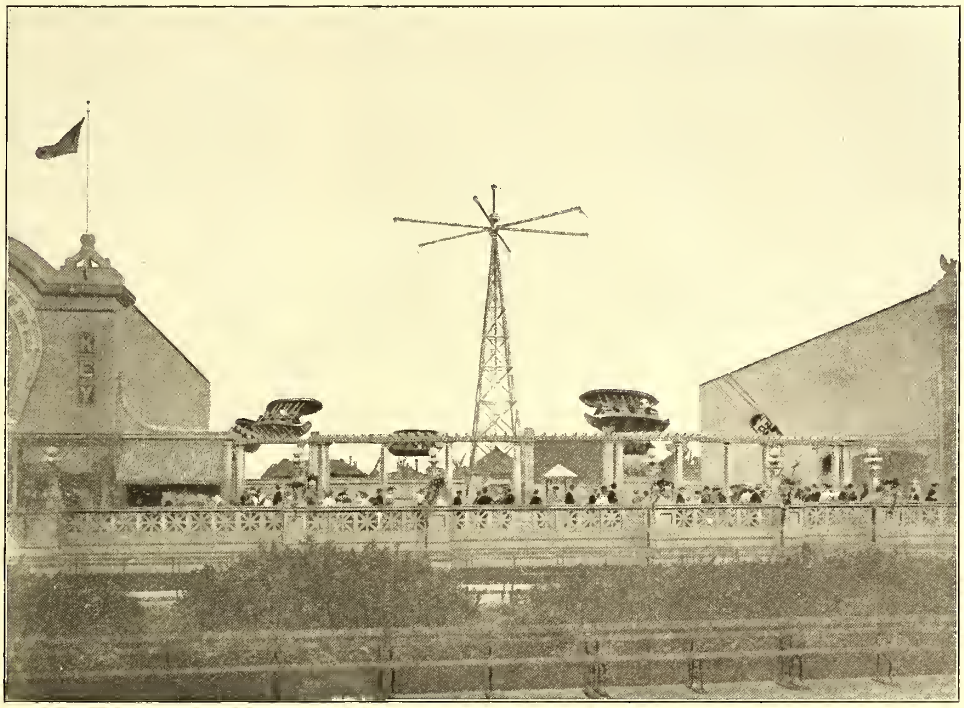
Cagney Brothers' Miniature Railroad Company, of New York, has long been favorably known for its manufactures in this branch of the amusement business. The rolling stock is usually built for either 15-in. or 22-in. gage, but can be made from 12⅝-in. gage to standard. The company is making its 15-in. gage equipment considerably heavier this year, and is also adding other improvements. That these little railways are thoroughly practical and safe, is demonstrated by the fact that they transported many thousands of passengers on the crowded Louisiana Exposition grounds without a single accident. More recently this company has supplied 22-in. railways to George C. Tilyou's "Steeplechase" parks at Bridgeport, Conn., and Coney Island, New York. Other orders are for Wichita, Kan., and such foreign points as Valparaiso and Havana. It is reported that the Brighton Beach Development Company, of New York, expects to install a miniature railroad from Brighton Beach to Manhattan Beach.

The Armitage-Herschell miniature railways (now controlled by the Herschell-Spillman Company, of North Tonawanda, N. Y.) are also widely used in pleasure parks in this and other countries. Every means has been taken to make them perfectly safe and enduring. In order to carry out this idea completely, the trains are equipped with air brakes which keep them under control at all times, and increase the life of the locomotives by eliminating the necessity of reversing. A large number of this company's miniature railways are built for 15-in. gage, but when desired larger gages, such as 22-in. or 24-in., are employed.

THE CIRCLE SWING AND AIRSHIP

Among the new amusement devices operated in the various pleasure resorts of the country, none enjoys a wider popularity and gives greater satisfaction than the circle swing flying machines or "airships," as they are generally called. The chief attraction of these devices is the exhilarating and cooling effect produced upon the passenger by the rapid motion through the air without any sensation of dizziness. A very attractive type of this apparatus, which is illustrated herewith, is made by the Traver Circle Swing Company, of New York. It was first brought out in the season of 1903, and since that time 68 have been built in many of the principal resorts of the country. No other large device has been placed in the principal resorts of the country so rapidly. The cars are suspended from strongly-supported arms at the top of the tower by ½-in. steel cables. These arms are attached to a solid steel shaft which runs to the base of the swing where the bottom of it is turned in a step-bearing, giving the greatest strength and safety to this all-steel structure. All of the steel parts of the plant are thoroughly galvanized to prevent rust. The cars are built for four, six, eight or twelve persons. They are modeled after airships to complete the illusion of an airship ride produced by the flight through the air. The seats are made of rattan stiffened with iron and upholstered with reed work over a frame in which many springs are placed. It is stated that the ride is so smooth and easy, that when tested it was found that a pail full of water could be placed upon a seat and the cars run to the maximum height and brought back to the starting point without spilling a single drop of water. The operation of the swing is noiseless and unaccompanied by any vibration, since the cars are swung into the circle by centrifugal force. The cars start from the ground level and are gradually moved faster and faster, the radius of movement and the speed being increased until the cars have attained their greatest height, after which the power is slowly reduced and the car is gently lowered to the ground where the passengers alight. The speed regulation is secured by an electric controller. The erection of these plants is superintended by expert and trained engineers, who have become specialists in this work. The company has installed swings from Maine to California, and from the Lakes to the Gulf, some of which are located in the following places: Paragon Park, Nantasket Beach, Boston, Mass.; the White City, Chicago, Ill.; Elitch Garden, Denver, Col.; The Chutes, San Francisco, Cal.: Forest Park Highlands, St. Louis, Mo., and Paradise Park, Fort George, N. Y.

A novel design of circle swing has been invented by K. Richardson, of New York, who was an architect at the late expositions at Buffalo and St. Louis. Briefly described, the Richardson circle swing consists of a circular umbrella-shaped tower supporting the mechanism, motor and arms from which the cars or "airships" are suspended. When the swing is in operation the airships move off in widening circles, affording a most delightful ride to its passengers. The principal features of this swing, aside from its more artistic design, are that it costs 50 per cent less; that the stability of the structure is in no way affected when overloaded on one side; that the tower, being constructed of wood, may be erected by a local builder, thus saving the expense in shipping and erecting a steel structure; and that it can be built very quickly.



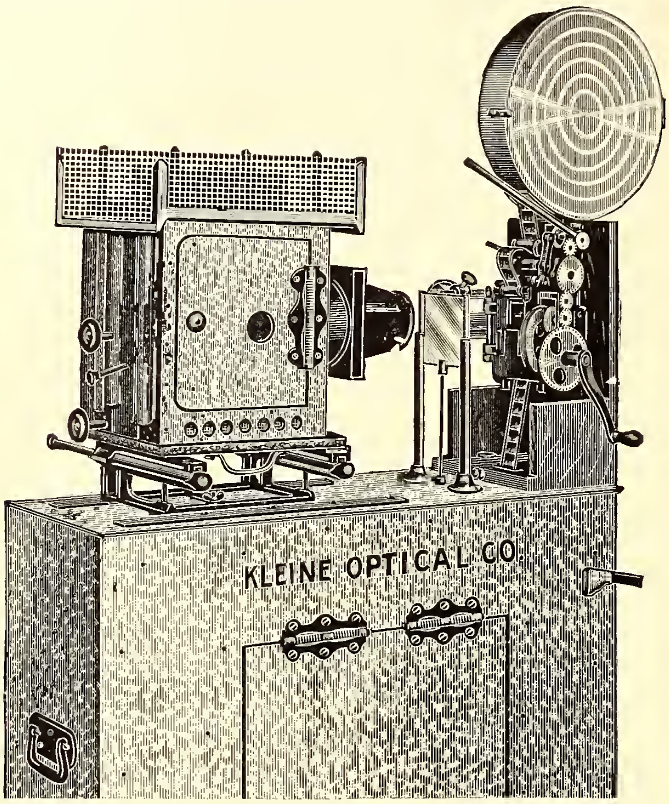
A CIRCLE SWING IN OPERATION AT THE "WHITE CITY," CHICAGO

Mr. Richardson is ready to furnish to his clients the plans and specifications of tower and cars and motor and mechanism of his invention, and also supervise the installation of the same if desired.

MOTION PICTURES AND MOTION-PICTURE MACHINES

Moving pictures can be had in such interesting variety today that there is little reason to fear that they will not prove good money-makers where the management exercises proper care in selecting the subjects. In this matter it is well to co-operate with the film dealers, who can give the park manager the benefit of their experience with this form of amusement in many different localities. Among the leading firms in this line may be named Miles Brothers, of New York and San Francisco, who not only originate a large number of attractive moving picture subjects, but are also in position to furnish practically every interesting film made. Miles Brothers have a special department devoted to the requirements of summer parks, and are prepared to co-operate with the railway managements in every way to make the moving picture feature one that will surely prove an excellent attraction and a most satisfactory investment.

After a great deal of experimenting, the Kleine Optical Company, of Chicago, has finally evolved a fireproof motion picture machine, which has not only passed the official Chicago inspection, but has met with the enthusiastic approval of exhibitors to whom the model has been shown. The various features embodied in this machine are intended to make it thoroughly practical as well as fireproof. Theaters operating in places which do not require precautions against fire will find this instrument a profitable investment, if for no other reason than that it saves films in case of accident, and may prevent panics. Among its points of merit are: A lamp-house entirely enclosed at all times, yet admitting all necessary adjustments of the lamp; equipped with wire netting and gauze according to city requirements. An electric lamp whose carbon-holders grip the carbons at all points, making perfect contact and holding carbons rigid. A lamp-house base which is absolutely impervious to heat. A heat shield between the lamp and the film, which is lowered by means of a treadle; when the operator removes his foot the shield returns automatically into place. An upper reel-box made of aluminum into which the flame cannot pass, if from any cause the film catches fire. A receiving box into which the exposed film passes. At the opening is a trap-door which is closed instantaneously by the operator in case of danger. There are four stout 7/8-in. steel supports, separately adjustable for inequalities in the floor, to support the complete machine. The moving picture mechanism, lamp-house, etc., are placed upon a heavy aluminum bed-plate which rests upon the receiving film box. The lamp-house slides to the right and left for stereopticon adjustment. The crank which actuates the motion picture mechanism is fastened with screws and cannot slip off while in use. The motion picture mechanism is the Edison exhibition model, equipped with special long, short or medium distance lenses, for stereopticon and moving pictures, as may be selected, but other mechanism can be used. The receiving film box is stoutly braced; the entire machine is strong, and will run without vibration.



FIREPROOF MOTION PICTURE MACHINE

Every machine bears the official approval stamp of the department of electricity of the city of Chicago.

LAUGHING GALLERIES

The J. M. Naughton Amusement Construction Company, of Columbus, Ohio, is handling the lastest types of comic glass mirrors as well as composition metal ones, which answer the same purpose. The laughing gallery has been a special study with this company, and it can offer some original ideas for installing and operating this attraction, furnishing construction drawings, ornamental designs, etc. One

FRONT VIEW OF THE "FUN FACTORY"

of the latest amusement houses devised by this company is the "Fun Factory," shown in the view herewith.

PARK MUSIC

For several years past Frank Willard Kimball, of San Francisco, has conducted a saxophone band which is declared to be the only organization of its kind in existence. The manager has labored for several years in preparing an extensive concert repertoire for the band, and the highest grade overtures, standard and operatic selections, etc., are readily played the same as in the large concert military bands and string orchestras. Some musical critics regard Mr. Kimball's success in this line as phenomenal, inasmuch as compositions of the character referred to have heretofore been considered out of the line of being effectively adapted or arranged for a small combination of instruments. Mr. Kimball's organization is composed of seven artists, and the organization is not only unique and a great musical novelty before the public, but the music produced is strikingly captivating and inspiring, for the saxophone voice fills a never-before-occupied place in the realm of tonal color, supplanting the somewhat disagreeable harshness of the brass instruments found in both orchestras and military bands. The organization is said to be one of the strongest musical attractions to-day in either America or Europe, and easily takes its place as the headliner on many programmes.

ELECTRIC SIGNS

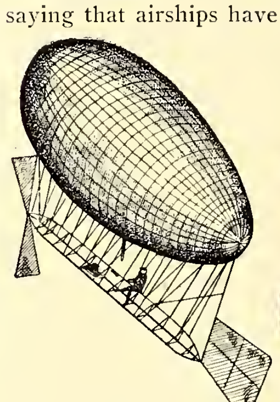
One of the invaluable accessories to an amusement park is the electric sign, for it indicates at a single glance the character of the individual resort and its attractions. When properly planned, such signs add very materially to the cheer-

A TYPICAL CAFE SIGN

fulness of a park as well as to its illumination. A couple of neat and inexpensive styles of these electrical signs are those reproduced herewith, which were made by the Haller Machine Company, of Chicago.

AERIAL NAVIGATION

After years of effort by hundreds of inventors to make a dirigible airship, a few types have been developed which bid fair to make aerial navigation possible. It goes without saying that airships have such a strong hold on the curiosity



AIRSHIP USED AT THE WHITE CITY, CHICAGO

AN ELECTRIC SIGN MADE IN SHIELD FORM

of the public that enormous crowds will be attracted whenever an airship flight is announced. In this connection, the exploits of Roy Knabenshue have become well known all over the country, particularly on account of his flights in Toledo, and later in Chicago and New York. Mr. Knabenshue is now with the U. S. Aerial Amusement Company, of Chicago, which is prepared to arrange for airship ascension from railway parks in any part of the country.

TWIN CITY RAPID TRANSIT COMPANY CREATES A DEPARTMENT FOR THE ENCOURAGEMENT OF EXCURSION TRAFFIC

A systematic effort is to be made by the Twin City Rapid Transit Company, operating in Minneapolis and St. Paul, and between those cities, to bring to the attention of the residents of that territory and also to visitors, the natural splendors available by means of the company's lines. In order to do this, a new department of the company has been created, to be known as the traffic department, in charge of which has been placed A. W. Warnock. The company's lines from Stillwater to Minnetonka abound with beautiful scenic waterways and resorts, and here is the beautiful view from Fort Snelling bridge, picturesque Minnehaha glen, pretty Como Park, Calhoun, Harriet and White Bear Lakes. And then there are rides from Stillwater to Lake Minnetonka. With a fleet of nine swift steamers on Minnetonka, the company will soon be in a position with its rail and lake lines to attract all the summer cottagers and make all-year-round cottagers of them, and will appeal most strongly to parties whether large or small to visit "the big lake" and enjoy its beauties. The company will makes its plans so attractive that Sunday Schools, lodges, societies and private parties will consider it an opportunity to make use of the lines. Chartered cars are to be popularized, and tours are to be arranged for parties which woud enjoy traveling exclusively, and yet economically.

APPLEYARD LINES SOLD

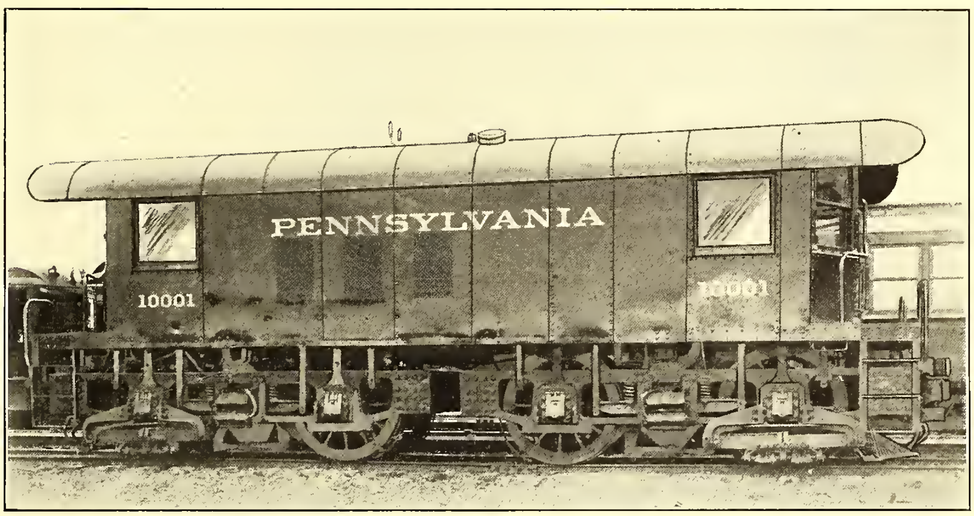
Two of the lines of the Appleyard system were sold at receiver's sale at Springfield, Ohio, Monday, Feb. 19. J. E. Locke, of Boston, representing the reorganization committee of bondholders, purchased both for the so-called Widener-Elkins syndicate, of Boston, paying $600,000 for the Dayton, Springfield & Urbana Railway, and $250,000 for the Columbus, London & Springfield Railway. These roads will be improved, and will form part of a through system across Ohio and Indiana. It had been intimated that there would be considerable competition in these sales, but the only other bidder on the Dayton, Springfield & Urbana was Graft Kennedy, who represented the stockholders. The Widener-Elkins interests also bought the lease of the Springfield & Western Railway, which is operated by the Dayton, Springfield & Urbana. Mr. Locke bought Tecumseh Park, on the line of the Dayton, Springfield & Urbana, for $2,000. About fifteen prominent traction men attended the sale.

MAYOR JOHNSON OPENS NEGOTIATIONS FOR CLEVELAND PROPERTY

Mayor Tom L. Johnson, of Cleveland, has reopened negotiations with the Cleveland Electric Railway Company looking to the sale of that company's property to a holding company to be controlled by the municipality. This scheme was broached some time ago, and was outlined in detail in this paper at that time. Without consenting to accept the proposition, Horace Andrews, president of the company, has agreed that Secretary Davies, representing the company, and E. W. Bemis, Mayor Johnson's expert, shall compile figures showing the earnings and operating expenses of the company and the probable increase in gross earnings, as a basis upon which to determine the purchase value of the property. Mayor Johnson is said to have intimated to Mr. Andrews that he had given up his 3-cent fare ideas and that he would not favor granting any extension of franchises to the company under any fare agreement or reduction from the present charge. Thus far he has been unable to induce the Legislature to legalize municipal ownership of street railway properties, and the scheme of a holding company is the nearest he can come to it. It would appear from this that the long investigation which the Chamber of Commerce has been conducting with a view to settling the franchise question is likely to come to naught as long as Mayor Johnson remains in office.

LONG ISLAND ELECTRIC LOCOMOTIVE

The "Brooklyn Eagle" recently published the accompanying engraving of one of the two electric locomotives recently delivered by the Westinghouse Electric & Manufacturing Company to the Long Island Railroad, and which are now



DIRECT-CURRENT ELECTRIC LOCOMOTIVE FOR THE LONG ISLAND RAILROAD

at the Morris Park shops. As will be seen, the locomotive body is mounted on two swivel trucks and is equipped with third-rail shoes. No electrical details of the locomotive were published.

SERIOUS WRECK ON THE LINE OF WESTERN OHIO RAILWAY COMPANY

One of the famous Lima Limiteds on the line of the Western Ohio Railway was wrecked Monday, this week; one passenger was killed and four were injured. Newspaper reports intimate that the accident was occasioned by the failure of the train crew to properly flag the rear end after a stop had been made to make some slight repairs to the trolley. It is stated there was a heavy fog, which prevented the crew of a northbound express car from seeing the limited, and a rear-end collision occurred. Morrice Stein, assistant auditor of the Western Ohio, had his neck broken by the accident, and was killed instantly. This is the first accident that has occurred since the Lima Limited service was instituted two years ago.

TESTING BONDS BY SNOW

Apropos of the question as to the best method of testing rail bonds, Frank W. Rivers, supervisor of tracks for the West Penn Railway Company, of Connellsville, Pa., writes that from observations he has discovered that when the tracks are covered with a light fall of snow, the snow will melt away at all joints where the bonds are defective more quickly than at joints where bonds are good. Accordingly, after a light snow storm a man is sent over the tracks with a pail of paint, and wherever a bad bond is shown by the melting of the snow, the joint is marked with paint and the track gang starts out immediately to replace the defective bonds. Some managers may have wondered at what possible use a snow storm ever was, and to what service it could be put, but the suggestion made by Mr. Rivers may perhaps point out one useful purpose in the street railway business to which snow can be applied after all.

MEETING OF EXECUTIVE COMMITTEES OF ENGINEERING AND ACCOUNTANTS' ASSOCIATIONS

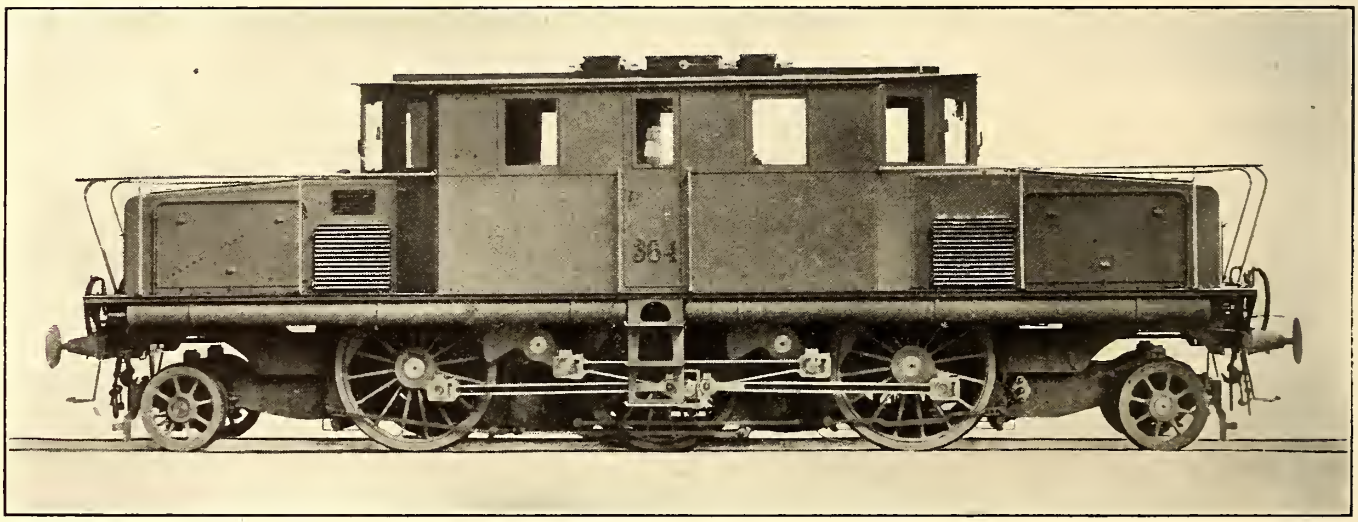
Meetings were held on Feb. 19 of the executive committees of the American Street and Interurban Railway Engineering Association and of the American Street and Interurban Railway Accountants' Association.

The former was held at the Manhattan Hotel, New York, and the following were present: Messrs. Adams, of Baltimore; Simons, of Milwaukee; Doyle, of New York; Winsor, of Boston; Twining, of Philadelphia; Bushnell, of Providence; Reed, of New York, and Mower, of Detroit. The meetings were devoted principally to drafting the new constitutions as required by the resolution adopted at the Philadelphia convention, so as to harmonize with the general plan of reorganization. A tentative form of constitution was adopted and will be submitted to the special committee, which consists of Messrs. Brockway, Adams and Swenson, and which was appointed by the American Street and Interurban Railway Association to pass upon it. At the conclusion of the work of revising the constitution, President Adams appointed the member of the association to represent the Railway Engineering Association on the committee on "Subjects" of the main association. An informal discussion followed upon topics to be discussed at the next convention.

The meeting of the executive committee of the American Street and Interurban Railway Accountants' Association was held in Mr. Brockway's office in New York. There were present Messrs. Brockway, of New York; Young, of Newark; Wallis, of Fitchburg; White, of Birmingham, and Tingley, of Philadelphia. The resignation from the executive committee of Mr. Pardee was announced, and E. F. J. Gaynor, auditor of the Interborough Rapid Transit Company, of New York, was appointed to fill the vacancy. The form of constitution was decided upon. In this constitution no provision is made for associate members, and the only active members are the member companies of the American Street and Interurban Railway Association. A programme of papers was also drawn up, and it was decided to have a question box this year, the same as last year.

THREE-PHASE LOCOMOTIVE FOR THE SIMPLON TUNNEL

The decision of the Swiss and Italian governments to equip the Simplon tunnel with three-phase traction has already been announced in these columns, and the accompanying engraving shows one of the locomotives built for this service by Brown, Boveri & Co., of Baden, Switzerland. The locomotives are equipped with two gearless motors, whose shafts are connected to the driving wheels by connecting-rods. Each motor is designed for two speeds, viz., 34 and 68 km per hour. The drawbar pull at the lower speed is 6 tons and at the higher speed is 3½ tons. The total weight of the locomotive is 62 tons and the weight on the driving wheels is given as approximately 42 tons.



ONE OF THE THREE-PHASE GEARLESS-MOTOR LOCOMOTIVES BUILT FOR OPERATION THROUGH THE SIMPLON TUNNEL

The electric locomotives will haul a train between Brigue and Iselle, a distance of about 20 km. The steepest grade is 1 per cent. The passenger trains will weigh 365 metric tons and the freight trains 465 metric tons. Current will be generated at 3300 volts and 15 cycles, and trolley wires will be used in the tunnel supported on span wires 25 meters apart.

An order has been posted on the bulletin board at the Augusta Railway & Electric Company's office to the conductors, giving them orders to allow negro nurses, accompaniel by white children to use any seat in the cars. It has been a rule in the past to allow the negroes the three rear seats in the cars, but when they have a white child with them it was thought best by the road to let them occupy the front seats. Shortly after a riot occurred on the cars several years ago, there was an order issued requiring all negroes to use the three rear seats. In South Carolina a railway is fined $100 if a conductor allows a negro to use any other seats.

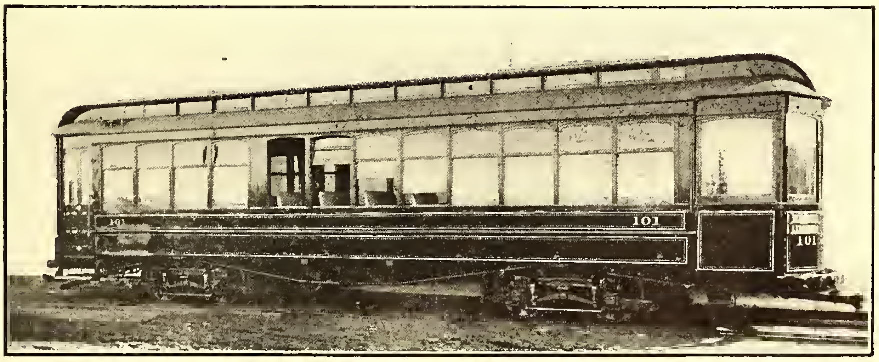
SEMI-CONVERTIBLE CARS FOR THE CENTRAL KENTUCKY TRACTION COMPANY

The Central Kentucky Traction Company, which is connected with the Lexington Railway Company, has lately placed on its lines a number of semi-convertible cars of the Brill grooveless-post type, built by the American Car Company. Each car is divided into two compartments by a hardwood partition with glass in the upper part of the sliding door and sides. One compartment seats thirty-three passengers and is for white people, and the other seats seventeen and is for the use of the colored people. Both compartments are finished in the same manner, the woodwork being of cherry

INTERIOR VIEW OF LEXINGTON CAR, SHOWING SEATING AND LIGHTING ARRANGEMENT

and the ceiling of birch veneer, decorated. The lights are placed singly in the dome and upon the side lining and have frosted-glass bulbs. The vestibules have doors at one side only, and as the entrances are at opposite sides of the car, it is intended that passengers shall enter and leave at the rear end. At the body ends the doors are set to one side close to the platform entrance, so that the platform affords considerable standing room without the danger of obstructing the movement of passengers in and out of the car.

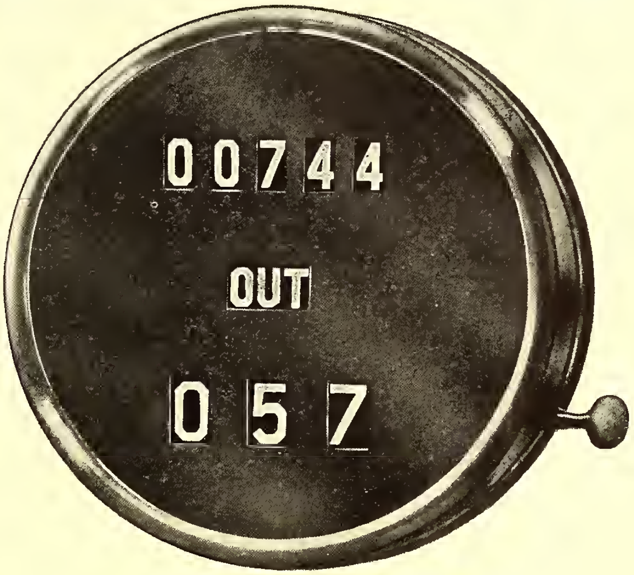
The seats are all of the push-over back type with the exception of those against the body ends, which have stationary backs and accommodate three passengers each. The seats are 36-in. long, upholstered in spring cane and are of Brill manufacture. Gates are provided at the entrances for use during warm weather. All of the sashes in the vestibules are arranged to drop into pockets, and the sashes in the car body are raised into pockets in the side roof when not in use. Several sash lock stops are provided to hold the windows open at any desired height. The bottom framing is of the usual substantial form employed in this type of car, and includes 12 ins. x 3/8 in. steel sill plates on the inside of the side sills, to which the base of the posts is secured. Under-truss rods are also used, as may be seen in the illustration. The cars measure 34 ft. 4 ins. over the end panels, and 44 ft. 4 ins. over the vestibules. The compartment for colored people is 11 ft. 10 ins. long; width over the sills, including panels, 8 ft. 2½ ins., and over the posts at belt, 8 ft. 6 ins.; distance between the centers of the posts, 2 ft. 8 ins.; height from the floor to the ceiling, 8 ft. 5⅞ ins.; height from the track to the under-side of the sill, 2 ft. 9 ins., and from the under-side of the sills over the trolley-board, 9 ft. 6 ins. The treads of the platform steps are 17¾ ins. above the rails. The distance from the steps to the platforms is 14 ins., and from the platform to the car floor, 8 ins. The cars are mounted on No. 27-G-1 trucks, with 4 ft. 6 in. wheel base, 33-in. wheels and 4½ in. axles. Four motors are used per car of 40-hp each. The weight of a car and trucks without motors, is 28,000 lbs.



GROOVELESS POST SEMI-CONVERTIBLE CAR FOR THE CENTRAL KENTUCKY TRACTION COMPANY, LEXINGTON, KY.

TWO NEW FARE REGISTERS

The Recording Fare Register Company, of New Haven, Conn., is just placing on the market two new types of registers, whose general appearance is shown in the accompanying cut. The principal features are simplicity in construc-



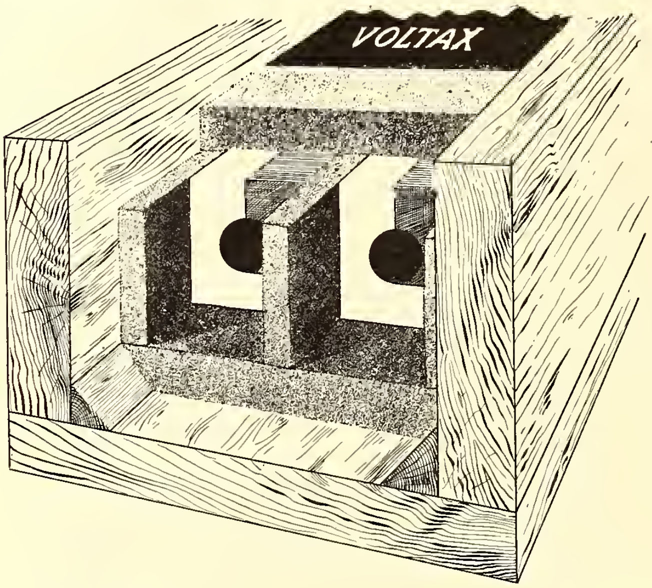
NEW TYPE OF FARE REGISTER

tion, few springs, practically no small parts, very large figures for both the trip and the totalizer, and ease of operation.

The registers are of the round pattern, eleven inches in diameter, and will be known as Types F and G. Type F is non-recording, while Type G is a recording machine. During the operation of resetting the trip register a record is made of the totalizer reading. The standard types of the recording fare register give a record of the actual number of fares registered on each half trip, while Type G records only the total statement at the end of each half trip. Both of the new types are full geared machines, with very large totalizer figures and extra large trip figures.

A NOVEL UNDERGROUND TRANSMISSION SYSTEM

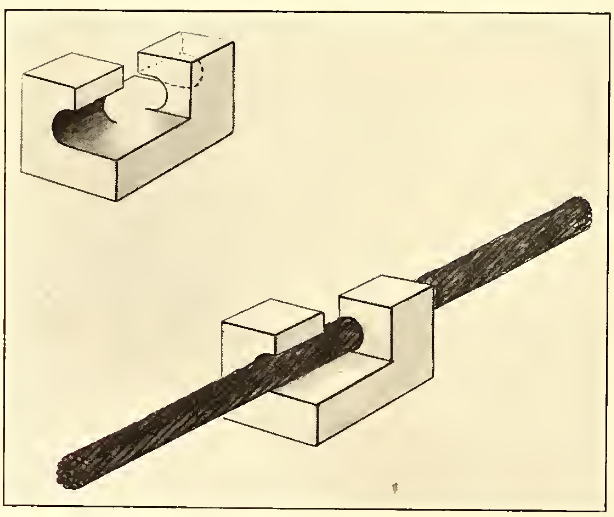
The Electric Cable Company, of New York, whose Voltax insulating compound was described in detail in the Street Railway Journal of Feb. 10, is introducing to American electrical companies an improved form of the wooden conduit transmission system used to a considerable extent by electric railway and lighting corporations in Germany. Instead of employing asphalt for filling the space between the wires



A PERSPECTIVE VIEW OF THE TRANSMISSION SYSTEM, SHOWING LAYERS OF IMPREGNATED FELT SURROUNDING THE BRIDGE WORK, AND VOLTAX BACKING

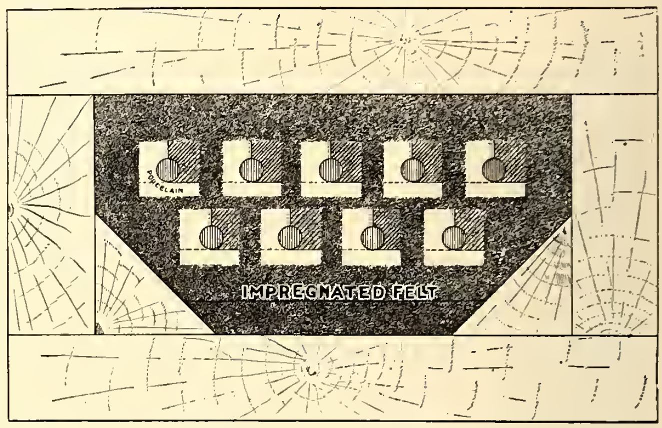
or cables, this company uses felt or other suitable material impregnated with Voltax, a compound whose resistance has been found to be so high that no commercial voltage ever generated can break down the insulation between the cables laid in a conduit with which it is filled.

When it is desired to lay down either a high or low-tension transmission system according to this system, a trench is dug about 18 ins. deep. In this trench a wooden trough is laid and porcelain bridgework placed therein for carrying the cables. These porcelain carriers, which are laid at intervals of 4 ft. or 5 ft., rest on and are enveloped by impregnated felt or similar material placed in the manner shown in the accompanying perspective sketch, the wires having been stretched and placed in position on this bridgework. The space between the bridge work is then filled with Voltax, which soon becomes solid.



FORM OF PORCELAIN BRIDGE USED FOR CARRYING CABLES

As this material will neither harden nor crack, it is next to impossible to get a short circuit between the conductors. Once laid the entire system is so durable that it requires no expense for maintenance, as there is no danger from short circuits, and even the wodwork is preserved from decay by a complete outer covering of Voltax which, it may be recalled, is waterproof and chemically neutral. In case a connection is required at any time, the trench is opened at the point desired, then by opening the box and melting the compound with a plumber's blow-torch, the connection can be made easily. After this the conduit may be restored to its former state of filling the box up at this point with a little of the compound mentioned.



CROSS SECTION OF CONDUIT, SHOWING BRIDGEWORK SURROUNDED BY IMPREGNATED FELT

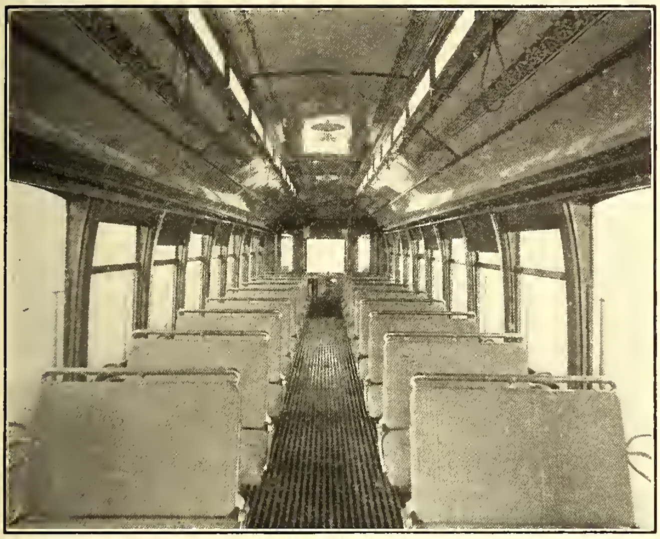
The cost of installing feed wires or transmission cables in this manner ready for service is between 25 per cent and 33⅓ per cent less than for cables of like size laid on the duct system, and it is believed will show a far superior efficiency and reliability. In answer to the prejudice still existing among some engineers against a solid system of insulation on the ground that they are unable to increase the capacity as readily as in conduits where they can lay extra idle ducts, it is asserted that by wiping out the cost of the annual maintenance which has always been borne in duct system, a solid system embodying two or three dead wires will cost less to lay than ducts, and that the interest on these extra wires is appreciably less than the cost of annual maintenance and extra ducts. Aside from these considerations, this system by avoiding the use of lead-covered cables prevents all possibilities of attracting stray outside currents or the electrical troubles caused by the breakdown of the insulation wall between the wire and its metal sheath.

WELFARE WORK IN ST. LOUIS

Extensive preparations for the welfare of the employees of the United Railways Company have been made by Capt. Robert McCulloch, vice-president and general manager. Already a hospital is nearing completion. A club house is being planned, and a loan fund has been started. Employees can borrow from this loan fund without fee or interest to the entire amount of their indebtedness. They can then repay the loans in small installments. Employees of the road can become members of the hospital association by paying 50 cents a month. Two fifteen-room residences have been purchased and are being converted into modern hospitals. Men injured on duty, who are members of the association, will receive treatment free and $1.50 a day besides, while they are unable to work. Men injured when not on duty will receive treatment and 50 cents a day. The hospital will be opened about April 1. The company recently purchased an old mansion, which is being fitted up as a club house, and will be accessible to all employees of the company. A brass band will be organized, and the members furnished with instruments and uniforms. A plot of ground will also be fenced in to be used for ball and other outdoor games.

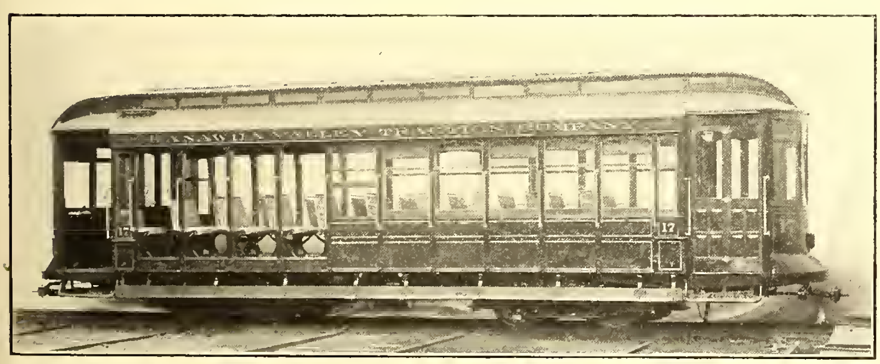
CONVERTIBLE CARS FOR CHARLESTOWN, W. VA.

Four handsome, grooveless-post, convertible cars, like the one shown in the illustration, have lately been delivered to the Kanawha Valley Traction Company, of Charleston, W.



INTERIOR OF KANAWHA CAR, SHOWING STYLE OF SEATING

Va., by the J. G. Brill Company, and six more of the same kind have been ordered. These cars are particularly interesting on account of the "Narragansett" type, double-step arrangement. This step arrangement is the same as used in the one-hundred convertible cars of the Brill type, built by the G. C. Kuhlman Car Company, for the Cleveland Electric Railway Company, and consists of Z-bar sills with the upper step on the outward extending lower flange of the bar.



CONVERTIBLE CAR FOR THE KANAWHA VALLEY TRACTION COMPANY, PARTLY OPEN

Corrugated malleable iron plates extend the step beyond the flange and give ample foothold for passengers. The illustration of a section of a side of the car gives a good idea of the arrangement. It will be seen that the sliding panels rest on the sill steps when lowered. The openings above the steps are covered by metal plates when the panels are down, and when the panels are raised into roof pockets, these cover plates fold against the back of the steps. One of these plates may be seen under the half-raised panel in the illustration lifted up to cover the opening. The reason for having the panels rest upon the sill steps is entirely for the sake of the better appearance of the exterior of the car, for if they

VIEW OF PART OF ONE SIDE OF THE KANAWHA CAR, ILLUSTRATING Z-BAR SILL CONSTRUCTION

are made to rest on top of the sills the open steps underneath leave a somewhat unfinished appearance.

The height of the running-boards from the rails is the same as the platform steps, 16½ ins., and the sill steps are on the same level with the platforms, the distance between running-boards and sill steps being 14½ ins., and from sill steps to the car floor, 8 ins. The arrangements permits the cars to be mounted on double-trucks having equal size wheels.

In addition to the grab handles, which are formed by the brackets between the backs of the seats and the posts, short grab handles are placed on the outsides of the posts. The guard rails slide on steel guides inside the posts. They may be seen in their raised position under the curtain-roller enclosure in the illustration of the interior of the car.

Cherry in the natural color constitutes the interior finish and the ceilings are of three-ply birch veneer, decorated. Brill seats are used which have push-over backs and wooden hand rails extending across the top of the seat backs. The length of the cars over the end panels is 28 ft. 4 ins., and over the vestibules, 38 ft. 4 ins.; width over the posts at the belts, 8 ft. 6¼ ins.; sweep of the posts 1½ ins.

The cars are mounted on No. 27-GE-1 trucks with solid forged-steel frames. The wheel base is 4 ft. 6 ins., the diameter of the wheels 33 ins., and the diameter of the axles 4½ ins.

FINANCIAL INTELLIGENCE

WALL STREET, Feb. 20, 1906.

The Money Market

There have been no important changes in the monetary situation during the past week. The tone of the market has been a trifle easier, but this has been caused largely by the falling off in the demand for money, as a result of the liquidation in the stock market, rather than to any pressure of funds by the banks and other lenders. On the contrary, the larger lenders of money do not look for any material easing off in rates in the near future, and for that reason they are not disposed to offer with any degree of freedom except at the full asking rates. The usual spring outflow of funds to the interior is now under way, and the surplus reserves of the New York City banks are smaller than at any corresponding period in recent years. In addition to the contemplated bond issues referred to last week, several new issues have been announced during the current week, the most important of which are an increase of $16,267,400 in the common stock of the Chicago & Northwestern Railway, which will be offered to stockholders at par, and an increase in the capital stock of the Delaware & Hudson Company of $7,000,000, the proceeds of which will be used largely to reimburse the company's treasury for the money spent in acquiring a half interest in the Schenectady Railway Company, and to pay for the stock of the United Traction Company, of Albany, which was recently acquired by the Delaware & Hudson Company. A noteworthy feature of the week has been a sharp decline in the rates of sterling exchange, the price of prime demand bills ruling fully a cent on the pound sterling below those prevailing at the close of last week. This slump in exchange was the direct result of the free offerings of finance bills by foreign houses, the proceeds of which were made available for local market purposes, and which eliminates all possibilities of gold exports to Europe. Government finances continue to show improvement. Receipts are still in excess of disbursements, the surplus for the month of February to date being $1,515,774, as against a deficit of $1,857,951 in the corresponding period of 1905. For the fiscal year to date the deficit amounts to only $1,857,951, as against a deficit of $25,100,524 in the same period last year. The bank statement, published last Saturday, was considerably better than had been expected. Loans decreased $9,616,000, owing to the shifting of loans from local institutions to foreign bankers. Deposits decreased $12,317,800. The loss in cash amounted to $3,233,100, but as the reserve required was $3,079,450 less than in the previous week, the surplus was reduced by only $153,650. The surplus now stands at $5,789,925, as against $9,204,425 in 1905, $27,506,600 in 1904, $9,041,675 in 1903, $12,456,650 in 1902, $14,546,675 in 1901, and $24,015,675 in 1900. The foreign money markets have ruled quiet and without material change in rates for money or discounts.

In the local market call money has loaned at 5 per cent and 3 per cent, the average rate for the week being about 4¼ per cent. Time money ruled practically unchanged at 5½ per cent for sixty and ninety days, and 5¼ per cent for four and six months. Specialists in commercial paper report a rather free movement of choice material at 5 per cent on the minimum rate. Other grades are quoted at from 5¼ per cent to 6 per cent.

The Stock Market

There was a further decided unsettlement of the stock market during the past week, which resulted in carrying the average of prices to a somewhat lower level than had been reached for a considerable time past, although during the greater portion of the period speculation was comparatively inactive and there was an absence of demoralization, such as might have been expected in consideration of the great pessimism that was manifest on every hand. Some liquidation of long stock took place, but the volume of this selling was extremely limited in comparison with that indulged in on the part of the bears, who detected in the rather gloomy feeling prevailing an opportunity to make a "turn" on the short side of the account. The fact that many of the so-called "big men" of the street were about to absent themselves on their customary midwinter vacations was taken advantage of by the professional operators in question, as was also the prevailing uncertainty regarding the probable outcome of the railway rate regulation discussion now on in Congress and the doubts existing concerning the likelihood of a coal strike. But the chief influencing factor was the hardening tendency of the market for time money, which created more or less apprehension that before long rates for call loans would be advanced to a much higher level, with a consequent depressing effect upon security values in general. The usual February lull in stock market operations was likewise counted upon as likely to be the occasion of a downward tendency, and in consideration of this and the other foregoing facts, it is not surprising that the market sagged. As previously noted, however, there was very little genuine liquidation, and stocks put out by the shorts invariably found ready takers. This not only served to check the downward current of values, but before the end of the week brought about quite a substantial rally from the low level, and at the close speculative sentiment was somewhat more cheerful, though it was still the general opinion that the market would continue rather narrow and more or less professional until such time as the prevailing uncertainties are cleared up. London gave evidence of the confidence in our securities by becoming a considerable purchaser thereof. Other favorable developments of the week included a declining tendency in rates for foreign exchange, a declaration of a large stock dividend by the Northwestern Railway, the placing of the Union Pacific dividend on a 6 per cent basis, and the publication of some phenomenal reports of railroad earnings, all indicating the great prosperity of the railroad industry, and the present exceptionally mild winter gave promise not only of continued large earnings, but of a material reduction in operating expenses. Thus the shares of the railroad companies, as a rule, were quicker to rally from the previous depressed state than the general run of shares, although the industrial securities were likewise looking up at the close.

The shares of the local traction companies moved more or less in unison with the general list, that is to say, they were depressed in the early portion of the week, but toward the close manifested a distinct rallying tendency. This latter condition is accounted for in part by the announcement that opposition to the Interborough-Metropolitan merger had been withdrawn. The "open" winter was another consideration that made for a better feeling in all these stocks, while in the case of Brooklyn Rapid Transit estimates were furnished that the earnings for the fiscal year would amount to about $18,500,000, or $2,000,000 in excess of those for the previous year.

Philadelphia

The local traction issues have been fairly active and generally firm during the past week. Philadelphia Rapid Transit was about the only stock to display weakness, the price declining from 32½ to 31¼, on selling said to be for New York account. About 5500 shares were traded in. Otherwise price fluctuations were confined to unusually narrow limits. American Railways sold at 53¼, and Consolidated Traction of New Jersey brought 82½ and 82 for about 1000 shares. Philadelphia Traction sold at 101¼ and 101 for small amounts. Union Traction was dealt in to the extent of about 800 shares at 63½, and an odd lot brought 63¾. The offer of the United Railway Investment Company, of San Francisco, for the purchase of a controlling interest in the Philadelphia company, was announced during the week, but the publication of the terms had no influence upon prices of the stocks of the latter company. Upwards of 10,000 shares of the common changed hands, at 53¼ to 52⅞ and back to 53, while small amounts of the preferred stock brought 49⅝ and 50. Other transactions included Railways General at 7 and 7⅛, Rochester Railway & Light preferred at 103½, and Fairmount Park Transportation at 20.

Baltimore

The Baltimore market has been less active and irregular. Interest was again centered in the United Railway issues, nearly all of which sustained moderate reactions as a result of profit-taking sales. About 1500 shares of the free stock sold at from 18⅝ to 17½, a loss of a point, while a like amount of the pooled stock brought prices ranging from 19¼ to 18½, a decline of three-fourths of a point. The free income bonds were fairly active, about $300,000 changing hands at from 74¼ to 73½. Of the deposited incomes only $41,000 were traded in, at from 73 to 72½. The 4 per cents were quiet but exceptionally strong, the price advancing to 94⅝, the highest price attained for a long time. Other transactions included Baltimore Passenger 5s at 105½, $46,000 Norfolk Railway & Light 5s at 100½, Virginia Railway & Development 5s at 99, Macon Railway & Light 5s at 100¼, Washington City & Suburban 5s at 105, Citizen's Railway & Light of Newport News at 88¼, and Knoxville 5s at 108½.

Other Traction Securities

The Chicago market has ruled quiet but firm. Metropolitan Elevated issues were exceptionally strong, 1200 shares of the common changing hands at from 27⅛ to 29, while 1500 shares of the preferred stocks brought prices ranging from 70 to 71¼. Chicago & Oak Park common advanced from 6½ to 7½, on the purchase of about 500 shares. Northwest Elevated sold at 26. A small lot of South Side Elevated brought 95, and twenty-nine shares of West Chicago Street Railway sold at 45. The Boston market was quiet, and prices generally displayed a downward tendency. Massachusetts Electric common was the active feature, upwards of 2200 shares selling at from 20¾ to 19. Of the preferred several hundred shares brought 69 and 68. Other transactions were: Boston Elevated at 156 to 155, Boston & Suburban common from 27 to 25, the preferred from 75 to 74 and back to 74¾; Boston & Worcester preferred from 83¾ to 83, West End common from 99½ to 99, and the preferred at 114. Interborough Rapid Transit exhibited decided weakness in the New York curb market. Opening at 232 it declined steadily to 227, the lowest price reached in weeks, and then rallied to and closed at 228. Upwards of 400 shares were dealt in. Interborough-Metropolitan common, when issued, was sympathetically weak, about 5000 shares selling at from 54¼ to 53. Of the new 4½ per cent bonds about $220,000 changed hands at prices ranging from 93¼ to 92½, and back to 92¾. American Light & Traction common sold at 122 and 124, and the preferred at from 102½ to 100. Other sales included 200 New Orleans Railway common at 38½, $35,000 Public Service Corporation certificates at 75 and 75½, $20,000 Public Service Corporation notes at 96 and interest, and $10,000 Jersey City, Hoboken & Paterson 4s at 76½.

Security Quotations

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

	Feb. 14	Feb. 20
American Railways	53¼	52
Boston Elevated	155	154¾
Brooklyn Rapid Transit	85	80⅛
Chicago City	190	190
Chicago Union Traction (common)	11½	12½
Chicago Union Traction (preferred)	42	44
Cleveland Electric	82	82
Consolidated Traction of New Jersey	81	81½
Detroit United	101	99
Interborough Rapid Transit	232	228½
Interborough-Metropolitan Co. (common), W. I.	53¾	53¼
Interborough-Metropolitan Co. (preferred), W. I.	94½	90
Interborough-Metropolitan Co. 4½s, W. I.	93⅜	92½
International Traction (common)	38	38
International Traction (preferred), 4s	75	75
Manhattan Railway	160½	158½
Massachusetts Electric Cos. (common)	19	18½
Massachusetts Electric Cos. (preferred)	68½	67
Metropolitan Elevated, Chicago (common)	26	29
Metropolitan Elevated, Chicago (preferred)	69½	70½
Metropolitan Street	120¾	117¼
Metropolitan Securities	71	69⅜
New Orleans Railways (common)	38	37
New Orleans Railways (preferred)	83	83½
New Orleans Railways, 4½s	—	90½
North American	102¾	100½
North Jersey Street Railway	—	25
Philadelphia Company (common)	52¾	52⅛
Philadelphia Rapid Transit	32⅝	31
Philadelphia Traction	101	101
Public Service Corporation 5 per cent notes	—	95½
Public Service Corporation certificates	—	74½
South Side Elevated (Chicago)	94	94½
Third Avenue	135	132
Twin City, Minneapolis (common)	118	116
Union Traction (Philadelphia)	63	63¼
West End (common)	99	99
West End (preferred)	113½	113½

W. I., when issued.

Iron and Steel

The iron and steel markets continue active and strong. The recent heavy purchases by the United States Steel Corporation has resulted in an advance in Bessemer of 25 cents a ton, and has also materially increased the demand and strengthened prices for foundry iron. The demand for structural steel is enormous, and it is estimated that between 400,000 and 500,000 tons of structural business is pending at the principal consuming centers. The American Bridge Company will probably book 50,000 tons of new business during February, the orders already received exceeding the tonnage of January.

INTERNATIONAL COMPANY'S CAR HOUSES BURNED

The car houses of the International Railway Company, at Stamford Township, just outside of Niagara Falls, Ont., were destroyed by fire Feb. 12. In the car houses were stored the cars of the Niagara Park & River road, the summer cars of the International belt line, and also the cars in use on the belt line at the present time. These were all destroyed, as well as several snow-plows of an up-to-date pattern, which had been purchased recently. The loss, estimated at $75,000, is fully covered by insurance.

EARNINGS OF THE NEW YORK CITY RAILWAY COMPANY

New York City Railway's statement for the Dec. 31 quarter compares as follows:

	1905	1904
Gross receipts	$4,453,875	$4,286,275
Operating expenses	2,471,462	2,354,407
Net earnings	$1,982,413	$1,931,868
Other income	313,956	318,731
Total	$2,296,369	$2,250,599
Fixed charges	2,812,000	2,791,543
Deficit	$515,631	$540,944

The general balance sheet of the New York City Railway Company, as of Dec. 31, 1905, compares as follows:

Assets—	1905	1904
Road and equipment	$5,106,883	$5,101,788
Stocks and bonds	8,657,877	8,613,332
Dividends accrued on stocks owned	13,893	13,893
Accrued interest	7,806	....
Supplies on hand	352,202	339,824
Open accounts	10,105,771	10,550,640
Cash	220,300	158,493
Cash on deposit and pay coupons	1,387,911	1,070,650
Prepaid accounts, insurance, rent, etc.	477,013	326,455
Profit and loss, deficit	5,566,555	2,481,213
Total	$31,896,215	$28,656,288
Liabilities—		
Capital stock	$9,099,200	$8,459,200
N. Y. City Railway 10-year notes	1,460,000	660,000
Loans and bills payable	5,200,000	1,800,000
Interest due and accrued	45,666	1,000,131
Rentals due and accrued	1,778,158	1,740,647
Taxes due and accrued	1,093,218	931,121
Coupons due, not presented	1,387,911	106,185
Open accounts	1,399,568	2,598,270
Due for wages and supplies	1,072,196	973,267
Metropolitan Securities Company, due them under subscriptions	8,116,800	9,556,800
Reserves for controlled companies	1,243,495	820,667
Employees' deposits	....	....
Total	$31,896,215	$28,656,288

CHICAGO AROUSED OVER DALRYMPLE INTERVIEW

Chicago was thrown into great excitement a few days ago by the publication in the "Tribune" of that city of an interview with James Dalrymple, manager of the Glasgow municipal tramways, who came to Chicago last year on invitation of Mayor Dunne to look over the street railway system and advise as to the possibilities of municipalizing the lines. Mr. Dalrymple in this interview says that Chicago street railways are in wretched condition; that the companies have no inducements to spend money on betterments owing to their uncertain position; that the proposals made by the companies for municipalization are fair; that if the city insists upon taking over all the lines at once, $75,000,000 would be only a starter, and enormous sums would have to be spent for improvements; that Glasgow, under municipal ownership, does not operate street cars any cheaper per car-mile than do the private companies of Chicago.

Mr. Dalrymple considers that when Mayor Dunne, of Chicago, asked him to visit that city and to make to him a report of the condition of the Chicago street car system with reference to its proposed municipalization, he did so for the city of Chicago, and not for the Mayor individually. This view also was held by the corporation of the city of Glasgow when it approved of Mr. Dalrymple's coming to America to study the Chicago street car problem. The report that was made to the Mayor has been suppressed, and Mr. Dalrymple has had a number of letters from prominent citizens of Chicago asking for copies of his report. To these requests Mr. Dalrymple replied that he regarded his letter to Mayor Dunne as more or less private, but that if the municipality of Chicago formally asked him for a report covering the same points as mentioned in the Mayor's letter he would be glad to send on such a report. The Chicago municipality did pass such a resolution asking for this report, and Mr. Dalrymple placed the whole matter before his corporation, so that they would have the responsibility. The corporation considered the matter for some time, and finally sent a letter to Mayor Dunne stating that they considered that when they gave Mr. Dalrymple permission to go to Chicago he was acting for the city of Chicago, and not simply as a private guest of Mayor Dunne, otherwise he never would have thought of going. The corporation also asked Mayor Dunne to hand out Mr. Dalrymple's letter and submit it to the City Council, or let them have a substantial reason why it should not be made public, and are now waiting for a reply from the Mayor.

In the interview Mr. Dalrymple said:

"Ever since my visit to Chicago I have closely followed the Chicago tramways problem, and can only confirm the opinion expressed in my first report submitted to Mayor Dunne that the condition of the plant of the Chicago railways to-day, owing mainly to the disputes going on between the different companies and the city, is in a most wretched condition. The tracks are miserable, and the entire system in a dreadful state of disrepair. I do not consider that the plant, roadbeds, or tracks ever were substantial, but to-day they are worse than ever. The entire plant and rails are utterly worn out. Of course, there has been no inducement to spend money on bettering the systems, owing to the uncertain position of the companies with reference to the continuance of private operation.

"As to the municipalization of the Chicago tramways, I have in my letter to Mayor Dunne given my ideas as to the best and quickest way of bringing this about under present circumstances. Undoubtedly there are difficulties in the way of doing this, one of these being the long franchise owned by the companies.

"I have been following the course of events closely and have considered carefully all proposals made by the companies to the city with reference to the terms of purchase. In my opinion the suggestions made by the companies are fair and reasonable.

"Of course, I am not saying whether the municipality should extend the franchises or not, but if they were not in a mind to extend the franchises the proposal of the companies that the city should acquire the entire systems is fair on a basis of the municipality gradually getting charge of the different lines and systems at stated times. This would surmount the difficulties of the long franchises owned by the companies. Therefore, I can see no reason why the city should not acquire the roads if it really wants them.

"To take over the railways would cost a vast sum of money, but the greatest cost would come in putting the lines and the plant in repair. I understand that $75,000,000 is proposed for this purpose. Well, that sum would just be a starter. The roads are in such a terrible condition that enormous sums would have to be spent on them to bring them up to what I call efficiency.

"I might mention that our entire Glasgow system cost only $15,000,000, but, of course, the Chicago street railway system is ten times larger than Glasgow.

"As to the question of municipalization itself I can only say that it works well here in Glasgow, but that is because we operate the lines just the same as if we were a private company. We are not in the least influenced by questions of politics. Our main concern is to run the lines and make them beneficial to our citizens and efficiently operated, just the same as they would be by a well organized private company, with all the advantages of private management, irrespective of public control, political influence, or jobbery.

"Glasgow to-day has the best paying street railway system in the world. Everything in connection with our tramways, both in regard to revenue and expenditure, is done as in operation by a private company. Whatever surplus we make goes toward the improvement of the plant and car service, extension of the lines, and increased facilities. We put on two cars in place of one wherever we consider it will better the service, and our equipment and plant are kept up to the highest order of efficiency.

"Our cost of operation is not any cheaper per car-mile than the cost in Chicago, for, though our wages are lower, our operatives do not work such long hours, and our cars are not run so fast as in Chicago. If you don't run your cars so fast you don't get as much work done. Neither is our revenue per mile much different from the American tramway lines, but our fares to the man on the street are cheaper. We have a 1-cent fare, and fares are graded according to distance up to 10 cents. The revenue works out about the same as the American 5-cent fare with transfers, but we think the 1-cent fare, ranging up to 4 cents, suits the largest body of the community.

"One great difference is that our cars carry almost twice as many people as those of the Chicago system. Therefore we can give twice as many people seats. We have seats on top of all our cars, each car carrying twenty-four inside and thirty-six on top. We carry twice as many people per car-mile as Chicago, and all our people get seating accommodation. One-third of our population pays only a 1-cent fare, and our average fare is considerably less than 2 cents."

Mayor Dunne challenged the testimony of Mr. Dalrymple in a statement which he made to the press on the morning following the publication of the article in the "Tribune." He laid especial emphasis on his argument that Mr. Dalrymple's report to him was privately, and not municipally, owned, and then attacked the assertion of Mr. Dalrymple that $75,000,000 would be only a starter of the cost to Chicago if it should buy and run its street railway properties. He said he preferred the estimates of Mayor Tom Johnson, of Cleveland, to those of Mr. Dalrymple.

The Mayor's reply was submitted to Alderman Forman, who represents the majority in the committee on local transportation, for an expression of opinion. He ridiculed the position taken by the Mayor that the Dalrymple report was his private property, and then suggested that if the Mayor really believed that Mr. Dalrymple was wrong in his position, it would be well to take the public into his confidence and tell the people of Chicago what plan he really has in mind in his attempt to obtain control of the street railway properties.

THE OHIO TWO-CENT LAW

The Ohio Legislature has passed a measure requiring steam railroads to give a 2-cent passenger rate. The measure, which will become operative March 10, attracted a great deal of attention among traction men, who differ as to the effect it will have upon traction roads. By many it is believed that it will result in the closer affiliation of, and the interchange of business between, the the two systems. Steam roads have always objected to electrics because of their lower rates, but as the majority of electrics have recently worked up to the 2-cent rate this objection is removed. The general opinion seems to be that the steam roads will still further, under the new law, reduce the short hauls and the frequent stops, which have always been spoken of as expensive and unprofitable, and also discontinue Sunday and holiday excursions. If this be done much of this business will revert to the electrics. On the other hand, there are those who think the new law will hasten the electrification of the steam trunk lines for passenger service, at least, and result in the steam roads taking over certain of the electric lines for the short-haul traffic, leaving the main trunk lines for through passenger and freight.

CAPT. McCULLOCH ON TRANSIT A DECADE HENCE IN ST. LOUIS

Capt. Robert McCulloch, vice-president and general manager of the United Railways Company, of St. Louis, in an address before the Missouri Historical Society, Friday evening, Feb. 16, said: "Underground railways for St. Louis ought to come within ten years. If the present rate of increase is maintained the million mark in population will have been reached in that time. Surface transit conditions will then demand improvement. There is such serious opposition to elevated railways that the underground system probably will be adopted to relieve surface congestion. The question has been discussed but only informally among our officials. During the year 1905 a total of 264,000,000 people rode on the street railways in St. Louis, or about 750,000 every day. This is more than four times the average of twenty years ago, when the city was half its present size. The habit of car-riding grows far more rapidly than the city itself, and overcrowded cars are already becoming unavoidable. Under its new management the United Railways Company is making preparations to improve its service immediately. Tracks will be laid with the ties imbedded in concrete 21 ins. thick, making the roadbed indestructible. Track construction will cost, approximately, $30,000 per mile. Ground is now being graded for the erection of a construction shop, where at least two cars a week, of the best known make, will be turned out until conditions are amply remedied. These cars will be of the latest and most commodious style."

Capt. McCulloch referred at length to the plans of the company in erecting club rooms and hospitals for the use of employees, the system of relief payments for absence enforced by injury, and other schemes adopted for the comfort and convenience of the men.

MERCHANTS' ASSOCIATION OF SAN FRANCISCO FAVORS OVERHEAD TROLLEY

The board of directors of the Merchants' Association, of San Francisco, has completed the poll of its members on the best method of improving the city's street railways. The poll was taken on the recommendations embodied in the report of William Barclay Parsons, who was retained by the association to report. Only 364 members voted, a disappointment to the board, as the number does not represent 25 per cent of the membership. The vote was on five propositions, as follows:

1. A uniform system of overhead trolley lines throughout the city, the railroad company to furnish a central line of ornamental trolley poles with lights between the tracks on Market and Sutter Streets. Yes, 121; no, 204.

2. An overhead trolley system throughout the city, except on Market Street. Yes, 67; no, 212.

3. Underground conduit system on Market Street and cable lines leading into Market Street in central downtown and adjacent residence district, remainder of the system to be overhead trolley. Yes, 198; no, 84.

4. What system do you favor for Sutter street: (*a*) Underground conduit, (*b*) overhead trolley with ornamental poles and lights, (*c*) and improved cable system?

	Conduit	Trolley	Cable
First choice.......	217	93	5
Second choice.....	42	83	62
Third choice......	7	14	94

5. Do you favor changing the cable lines on Nob Hill to electric lines by tunneling the hill and constructing a winding driveway with parks on California Street? Yes, 158; no, 140.

In its report on the canvass the board says it originally favored the underground conduit system, and had intimated as much to Mr. Parsons, but that he reported in favor of the overhead trolley system. The report says further that the United Railroads was opposed to the underground conduit system, on the grounds that it increased complexity, introduced a third method, and that 98 per cent of all electric roads in this country used the overhead trolley. The report says that the board is informed by its attorney that there is no legal way by which the railroads can be compelled to install the underground system; that most of the franchises will not expire for twenty-three years, and if the roads so desire they can maintain the present system for that time; that only in the case of new franchises can the city dictate the system to be used. The board declares that immediate relief is needed; that straphangers are increasing in number; that the cities across the bay are growing at the expense of San Francisco; that it is no longer a question of overhead trolley or underground conduit, but of overhead trolley or cable, and that as a choice between the two it would be better to have an overhead trolley of the best system established on Market Street and throughout the city than to have the cables occupy the streets for the next twenty-three years. In its conclusion the board says:

We are convinced that it is for the best interest of San Francisco that the best system that can be had at the present time should be secured, and that it is the duty of the municipality to take all necessary steps to this end, without delay. Therefore, as the result of long deliberation, and after a thorough study of Mr. Parson's report and of all the conditions existing here, your board has unanimously reached the following conclusions:

1. That all cable lines, except those on steep grades, be abolished as soon as possible. Their slot-rails and underground construction should be completely removed from the streets, which should be left in the best possible order.

2. That as the overhead trolley appears to be the only possible system that can now be secured for lines with existing franchises, that system should be adopted generally upon certain definite terms.

3. That overhead trolley lines be installed as soon as possible on Market, Valencia, Castro to Twentieth, Haight, Hayes, McAllister, Sutter, Polk, Larkin, Ninth, Montgomery Avenue, Powell and Union Streets, under the following conditions:

(A) That on Market Street, from the ferries to Castro Street, a central line of ornamental poles, with electric lights, of the same design as those used in Cologne, Germany, be placed between the tracks, the lamps on said poles to be kept lighted every night, all night, by the railroad company, free of cost to the city, and that all feed wires be placed underground.

(B) That only acceptable ornamental side poles be used on all other streets where cable lines are changed to electric, and that all feed wires on these streets be placed underground.

(C) That the same kind of ornamental trolley poles be substituted for the present unsightly trolley poles on all other electric lines now existing within the district bounded as follows: Devisadero, Seventeenth, Guerrero, Twenty-Sixth, Folsom, Tenth, Brannan and the bay shore

(D) That the company maintain, free of cost to the city, ornamental arc lights, lighted every night and all night, on all poles on the following streets, on which the cable lines are changed to trolley: Valencia Street, Hayes, from Market to Fillmore; McAllister, Market to Fillmore; Sutter, Market to Polk; Post to Pacific Avenue; Larkin, Market to Post, Ninth, Market to Folsom; Montgomery Avenue, Washington to Union, and Powell, Market to Sutter.

(E) That all cars on the new electric lines substituted for cables be provided with air brakes.

(F) That the United Railroads shall, within twenty-four months, extend its electric lines into the following outlying districts, over routes to be determined by the Board of Supervisors, provided said board is willing to grant the company the necessary franchises:

1. Sunset district.
2. University Mound district.
3. South San Francisco, to the dry dock at Hunter's Point.
4. Golden Gate valley district (between Van Ness Avenue and the Presidio) and along the water front, from Broadway to Montgomery Avenue.

(G) That the horse-car line on California Street, from Montgomery Street to the ferries, be either abolished or changed into an electric line.

(H) That the horse-car lines from the ferries to Montgomery Avenue be abolished, and an electric line be substituted.

(I) That if the property owners on Pacific Avenue prefer a cable line to a trolley, improved cars be furnished, and that such cars connect with the Washington Street line and go to the ferries via that route.

STOCK GUARDS FOR PENNSYLVANIA ELECTRIC LINE

The Pennsylvania Railroad has placed an order for the cattle guards to be used on the new electrified division of the West Jersey & Seashore Railroad, between Camden, N. J., and Atlantic City, with the Climax Stock Guard Company, of Chicago. This contract calls also for their complete installation. These guards are of the clay type, and about thirty carloads will be required.

The Pennsylvania Railroad Company expects to have this line in operation by electricity on July 1.

ANNUAL MEETING OF CHICAGO CITY RAILWAY—CHANGES IN PERSONNEL—OPERATING FIGURES

At the annual meeting of the stockholders of the Chicago City Railway Company, held on Friday, Feb. 16, the policy of improvements of the present management was indorsed, sanction was given for carrying on important new work, and a number of changes were made in the personnel of the company. The directors were re-elected as follows: John A. Spoor, chairman; E. J. Earling, Robert M. Fair, T. E. Mitten, Edward Morris, P. A. Valentine and Lawrence A. Young. Mr. Spoor and Mr. Morris were made the executive committee of the board, Mr. Morris succeeding Mr. Valentine, whose business requires most of his time in New York. The officers elected are T. E. Mitten, president; Mason B. Starring, vice-president and general manager; J. B. Hogarth, secretary and auditor; J. P. Burke, treasurer. The retiring officers are Lawrence A. Young as vice-president; C. N. Duffy as secretary and auditor; T. C. Penington as treasurer. Mr. Penington was voted half-pay on retirement by the directors, in view of his long service with the company. Most important among the new work decided upon are the purchase of fifty new cars and the improvement of the company's plant at Vincennes Avenue and Seventy-Seventh Street.

The report of operations of the company for the year 1905, as submitted to the stockholders, showed net earnings of $1,679,473, a loss of $67,385, or 3.86 per cent. The loss was made notwithstanding an increase of $631,170 in gross earnings. Operating expenses, however, increased $720,486. The earnings on the stock were equal to 9.33 per cent on the outstanding capital of $18,000,000, which compares with earnings equal to 9.7 per cent last year. The gross earnings for the year were $7,322,080, an increase of $653,100.87, or 9.79 per cent. The local expenses were $5,642,606, an increase of $720,486, or 14.64 per cent. This increase is due principally to the additional number of cars operated, the additional expense incurred in improving the heating facilities and sanitary conditions of the cars, together with the increased amount necessarily charged to depreciation to cover the value of a number of the older cars, which have been retired from service and destroyed. Following are the figures of operation, with comparisons:

	1905	1904
Passenger receipts	$7,240,671	$6,609,501
Receipts from other sources	81,408	59,478
Total earnings	$7,322,080	$6,668,979
*Operating expenses and taxes	5,642,606	4,802,120
Net income	$1,679,473	$1,866,859
Depreciation	....	120,000
Earnings on stock	$1,679,473	$1,746,859
Dividends	1,620,000	1,620,000
Surplus for year	$59,473	$126,859

* Includes depreciation charges for 1905.

Following the usual custom, the company issued no balance sheet. The percentage of expenses to gross earnings was 77.06, an increase of 3.25 per cent. Passenger receipts per day were $19,834, an increase of $1,778. With an increase of but 9.52 per cent in passengers paying fare, there was an increase of 13.09 per cent in passengers using transfers, over 60 per cent of the passengers paying fare having taken advantage of the transfer system, the average fare being but 8.10 cents per passenger carried. The operating statistics for the year follow:

PASSENGERS CARRIED	
Fare passengers (increase 9.52 per cent)	145,500,483
Transfer passengers (increase 13.09 per cent)	87,911,785
Fare and transfer passengers (increase 10.84 per cent)	233,412,268
Percentage of transfer to fare passengers	60.42
CAR EQUIPMENT	
Electric (53.90 per cent of total, increase 28.37 per cent)	905
Cable (45.68 per cent of total, decrease 2.66 per cent)	767
Horse (0.52 per cent of total)	7
All (increase 11.93 per cent)	1.679
MILES OF SINGLE TRACK	
Electric (84.14 per cent of total)	184.20
Cable (15.86 per cent of total)	34.75
All	219.14

President Mitten submitted the following report:

"After very careful investigation a large and commodious type of car, suitable for both summer and winter service, was decided upon, and 200 cars of this description purchased and placed in service.

"The 205 large electric cars now operated on Wentworth Avenue and Halsted Street are being rebuilt, rewired, equipped with modern electric heaters, repainted, and as nearly as possible brought up to the same standard of excellence as the new car. This work is being done as rapidly as shop facilities will permit.

"Two hundred and fifty of the better type of single-truck electric cars have been equipped with electric heaters, thoroughly overhauled and repainted, and are now in good operative condition.

"In order to meet the public demand for increased car service and also to heat the cars satisfactorily, a contract for the purchase of electric power from the Commonwealth Electric Company has been entered into. Sub-stations for the distribution of this power have been erected on this company's property at Twentieth and Dearborn Streets and on Wentworth Avenue near Sixty-Third Street. These sub-stations are of the most substantial character, and contain the most modern and economical electrical machinery, capable of transforming a maximum of approximately 15,000 hp, which amount should be sufficient to meet all demands prior to the electrification of the cable lines. Portions of the track on Twenty-Sixth Street, Sixty-Third Street and Forty-Seventh Street have been reconstructed, and new terminals established on Wentworth Avenue near Sixty-Third Street, and also at a point on Sixty-Third Street convenient to the White City. Material improvement in the fire risk at the several power houses and other buildings of the company has been effected, which has considerably decreased the possibility of loss by fire. These changes have also served to materially decrease the rate of insurance for the current year."

FREIGHT BY TROLLEY AND STEAMER FROM BOSTON TO NEW YORK

A rather peculiar and interesting feature of the pending negotiations of the Old Colony Street Railway Company, looking to the establishment of a freight and express business over its lines between the cities in southeastern Massachusetts, Providence, R. I., and Boston, is the possibility that this service will be extended to handle matter through from this territory to New York City by way of a steamboat connection through Long Island Sound. That such an outlet to New York is contemplated by the Old Colony Street Railway is virtually admitted by its effort recently to get a franchise for tracks in Fall River, connecting the company's existing trunk line in that city with the wharf of the Enterprise Transportation Company, a new company operating a line of steamers somewhat smaller in size than the big sound liners.

This connection will be the first attempted between steamboat and railway lines in Massachusetts for any considerable amount of mercantile traffic; but it is looked upon as likely to have a very interesting effect on the general freight business between Boston and New York, to say nothing of passenger business. It is not inconceivable that a considerable amount of the light freight between Boston, or at least the manufacturing cities of Taunton, Brockton and New Bedford, and New York might be deflected from the railroad and carried by way of the trolley route and the independent steamboat line.

It is barely possible that the Fall River grant to the Old Colony Street Railway Company may not get by the Railroad Commissioners without some considerable revision. It includes numerous restrictions or conditions, imposed on the company by the local authorities. These are not only in excess of the requirements imposed by Taunton and Brockton, but it is a question if they are not contrary to the policy approved by the Railroad Commission in other freight petitions so far approved. The Commission has in general been loth to approve any special conditions imposed by the local authorities, taking the ground that the companies should have equal chances in all communities without being hampered by special impositions not strictly related to the business of carrying freight. Some of the conditions in the Fall River grant now awaiting action by the Railroad Commission are that the freight cars shall make no stops on the public streets except where obliged to stop by other traffic; that cars shall not be run in pairs or trains; nor on Sundays except for through baggage; nor at any time except between 10 p. m. and 5 a. m., and that the company shall remove all snow, and shall be required to have its freight rights renewed after five years, and if it makes any traffic agreements with connecting roads shall make them for not more than one-year terms. Whether the State Board will allow all these to stand appears to be an open question.

COMPARATIVE COST OF ELECTRIFICATION OF TWO EUROPEAN RAILROADS

In the course of an address on the electrification of steam railroads, delivered recently before the Austrian Engineers' and Architects' Society, Baron Ferstel presented an interesting comparison of the relative costs per mile of electrically equipping the trunk lines of Sweden, as given by Mr. Dahlander, the engineer in charge of that project, and of a typical Austrian railroad operating in a mountainous country.

The State railroads of Sweden comprise two north and south lines with very few branches. This fact, taken in connection with the sparse traffic, presents a very unfavorable condition as regards the economy of electrification. Consequently, all of the changes must be made at the lowest possible cost. One favorable circumstance, however, is the availabilty of using water powers, which, in general, are quite near the main lines, so that expensive transmission systems can be avoided. To fill the power gaps which would be left by the seventeen hydro-electric plants totaling 80,000 hp, there will be five steam stations, giving a total of 22,000 hp. The fuel used for these stations is a Swedish turf, which has been found unavailable for locomotive use. The annual expenses for interest on the investment, maintenance and renewals of the transmission lines, hydro-electric and steam power stations, operating costs, wages, etc., are figured at $2,667,500, while the saving resulting from giving up the steam service is estimated at $2,182,500, leaving a yearly deficit of $485,000. On this basis the Swedish Government has consented to electrification in the belief that the present cost of coal (about $4.73 per ton) is an extraordinarily low one, for if the price of coal should advance only $1.45 (and at times it has been $3.05 higher than at present) electrical operation would be cheaper than steam. An increase in traffic would also involve less expense with electrical operation than with steam, as in the latter case the cost is proportional to the number of trains.

Baron Ferstel then presented an estimate which he had prepared for an existing 400-km line in the Austrian Alps. The line is single track, and has annually 9000-train-km, 2,000,000 gross ton-km, and 324,000-axle-km, against 170,000-axle-km on the Swedish railroads. The average grade of the 400-km line is 2.658.

The transmission line, including transformers, working conductor, feeders, etc., for single-phase service, would cost $8,487.50 per km. Electric locomotives (including repair facilities and reserve) for handling the traffic mentioned were placed at $7,275 per km. The cost per horse-power from the proposed hydro-electric stations would be $100.40, and as the total amount of power required was estimated at 75 hp per km, the cost of power generation will be $7,275 per mile of line. The total cost per km would then be $23,037.50.

Comparing these figures with those given by Mr. Dahlander (also for single-phase operation) the following differences will be noted: Cost per km for transmission system of Swedish line $3,637.50, and of Austrian $7,275; cost of Swedish electric locomotives per km of line $2,425, and of the Austrian $7,275. The installation cost of the Swedish power stations is not given, but according to the estimate covering interest on the investment, maintenance and operation, the charge per horse-power-year from the hydro-electric stations would be $11.64, while $14 would be the average cost for the combined hydro-electric and steam plants using turf for fuel. For the Austrian project the cost per horse-power-year from a water-power station would be only $8.58.

The great differences in the costs of the corresponding factors entering into these projects may be ascribed partly to the less traffic on the Swedish line, which reduces the locomotive cost per km, and partly to the fact that in the Swedish installation the hydro-electric and steam stations will be so located that no long and expensive transmission system will be required. In comparing the annual cost of power per km in Sweden the figures are $334.65, as against $643.84 in Austria. This is due to the denser traffic, which requires 75 hp per km in Austria, as against 24 hp per km in Sweden.

Assuming that under electrical operation the renewal, maintenance and labor cost will not be higher than with steam, then at a capitalization of $24,250 per km the interest charges of $927.50 per km should be less than the saving in coal to make the change commercially successful. The coal required to transport 1000 gross ton-km on level track is 63.8 kg, but on the proposed line, which has an average grade of 2.685 per cent, the coal consumption is 171.3 kg. This gives a consumption of 342.6 tons for the traffic of 2,000,000 gross tons per km. Coal delivered costs $4.31, and multiplied by the tons used (342.6) gives a total of $1,478.76 per km, whereas the interest on the total electrical investment per mile would be only $848.75, so that the difference in favor of electrification is about $630.50 per km. This saving would increase with denser traffic and higher coal, and decrease with lighter traffic and cheaper coal. The saving would be $242.50 greater if the war department did not require the steam locomotives to be held as a reserve.

Another, and practically the deciding, factor entering into this problem is that of the comparative costs. This amount depends upon whether one man per electric locomotive will be sufficient, as on the Valtellina line, or whether two men will be employed, as is done on certain of the English electrified railways. On the 400-km line under discussion there are in all 162 locomotive employees, whose wages are $47,142 per year, or $121.25 per km.

Baron Ferstel also pointed out that the cost for maintaining tunnels would be greatly reduced by eliminating locomotive gases, and the repairs of electric locomotives would be less than for steam. On the latter point it must be remembered that repairs to the weakest part of a steam locomotive, the boiler, put the entire machine out of commission, whereas the weakest part of an electric locomotive, the motors, can be repaired separately, and the machine put in service with new motors in an hour or two. When the maintenance cost of the generating and transmission systems are added, the difference in favor of electricity is not so overwhelming, but is still considerable if the Valtellina figures be accepted as a criterion. In discussing the 400-km line no attempt was made to place the electrical operating costs at a minimum, yet the estimated difference from the steam figures proved so small as to be negligible. Minor advantages, due to electrical operation, are the diminution in the number of firemen, reduction in shop expenses, lower cost for illumination, abolition of water and coaling depots, etc.

In conclusion, the speaker mentioned that about 3000 km of railways which pay high prices for coal are favorably situated for the utilization of water power. This condition has not been overlooked by the Austrian Government Railroad Commissioners, who are now making a detailed study of the situation, with a view toward electrification of some of the existing lines.

MICHIGAN PROPERTY FORMALLY TRANSFERRED

The St. Joseph River Traction Company, organized to build an electric railway from Benton Harbor to Niles, Dowagiac and Kalamazoo, has been consolidated with the Southern Michigan Light & Power Company, under the name of the Benton Harbor & St. Joseph Electric Railroad & Light Company. The capital of the new organization is $1,000,000. Col. W. W. Bean, former owner of the Benton Harbor & St. Joseph Street Railway & Lighting Company, has turned over the property to the new owners. James G. McMichael, vice-president of the merged companies, is also president of the Atlas Railway Supply Company, of Chicago. The other directors of the company are: F. M. Mills, of Benton Harbor; Charles Minary, of Springfield, Ill.; William Jarvis, of Louisville; Humphrey S. Gray. The officers are: Charles K. Minary, president; L. W. Botts, of Louisville, secretary; Frank M. Mills, of Benton Harbor, treasurer; Henry C. Mason, general manager, and H. S. Gray, of Benton Harbor, attorney. Among the important financial interests connected with the new company are: William Jarvis, of the Louisville Railway, of Louisville, Ky., and Mr. Botts, vice-president of the Columbia Finance & Trust Company, of Louisville.

The St. Joseph Company has purchased the rails for the extension of the line to Eau Claire, by the way of Fair Plain and Tabor's. The grading for this line is now completed, and it is expected that the road will be ready for operation to Fair Plain by April 1, and to Eau Claire by June 16. Besides the line to Eau Claire the company has in contemplation a road to Kalamazoo, the construction of which will probably be undertaken later in the season. Power is expected to be delivered from Buchanan this month. With its installation the rates for light and power will be reduced and better service will be given. Col. Bean, who retires from the company, will take a well-earned vacation. He came to Benton Harbor from Dayton, Ky., seventeen years ago, and bought the street railway line between Benton Harbor and St. Joseph, which he equipped with electricity.

The administration of the Ferro-Carril Urbano de Tampico, S. A. Tampico, Tamaulipas, Mexico, has determined to extend its lines outside of the city to Paso de Dona Cecillia y La Barra. This new road will be 10 kilos long, will be narrow-gauge, employ rails weighing 40 lbs. per yard, and will use steam.

THE CENTRAL ELECTRIC RAILWAY ASSOCIATION

As previously stated in the STREET RAILWAY JOURNAL the Central Electric Railway Association, which is the consolidation of the Ohio Interurban Railway Association and the Indiana Electric Railway Association, will establish a permanent office in the Traction Terminal Building, Indianapolis, March 1. John H. Merrill, at present auditor of the Western Ohio Railway, will resign at that date to become permanent secretary of the organization. Before going with the Western Ohio Company, Mr. Merrill was manager of the Ohio Central Traction Company. He has been prominently identified with the Ohio Interurban Railway Association, having been one of its organizers and its first secretary. He is chairman of the transportation committee of the organization, and it was due almost entirely to his efforts that the interchangeable coupon plan of transportation was put through and adopted by more than thirty-five roads in Ohio, Michigan and Indiana. The duties of the new office will consist of compiling and promulgating operating data of value to the members, the handling of interchangeable transportation matters, working out through passenger and freight arrangements, the publication of time cards and folders, covering all the roads in the district, and general publicity work in the interests of traction lines. It was at first thought that the office would be located in Dayton, but Indianapolis was decided upon because of the interest in the movement being shown by some of the Western roads. In event of their joining Indianapolis would be the central point in the association territory. The next meeting of the association will be held in Indianapolis on March 22.

J. H. MERRILL

EVERETT-MOORE SYNDICATE NEGOTIATING FOR DETROIT, MONROE & TOLEDO SHORT LINE

Negotiations are said to be pending between the Everett-Moore syndicate, of Cleveland, which controls the Detroit United Railways of Detroit, and the owners of the Detroit, Monroe & Toledo Short Line, for the purchase of the latter property. The Detroit, Monroe & Toledo is one of the finest high-speed roads in the Central West. Shortly before its embarrassment the Everett-Moore syndicate acquired this property and the Detroit & Toledo Short Line, a steam road, the plan being to make a double track system between Detroit and Toledo. After the embarrassment both properties were sold, the Detroit, Monroe & Toledo Short Line reverting to Mathew Slush, Judge Riley and associates of Detroit. The members of the Cleveland syndicate were disappointed at being obliged to dispose of these properties on account of their plans for a through system, and it is known that they have long contemplated getting it back as soon as they were in position to do so. If the deal is put through the road will doubtless be merged with the Detroit United Railways, which controls all of the interurban roads out of Detroit except two.

STREET RAILWAY PATENTS

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

STREET RAILWAY PATENTS ISSUED FEB. 13, 1906

812,277. Turbine-Driven Locomotive; Hugo Lentz, Berlin, Germany. App. filed Aug. 16, 1905. Relates to novel means for mounting a turbine on a locomotive.

812,561. Overhead Line; Emile Giraud, Paris, France. App. filed Oct. 31, 1903. A hinged hanger which moves to ground the conductor or connect it to another circuit in case the conductor breaks.

812,571. Car Fender; John Landau, Jr., New York, N. Y. App. filed June 24, 1905. Comprises a lever frame fulcrumed on the car body, a basket removably connected with the lever frame, spring-pressed rods pivotally connected with the lever frame, and a manually-controlled device for imparting a swinging motion to the lever frame and basket to bring the forward end of the basket to the desired distance relative to the track.

812,581. Switch-Throwing Mechanism; Henry O. Marquis, Superior, Pa. App. filed Nov. 21, 1905. A casing mounted in the roadbed has recesses in its upper face, and eccentrics mounted in the casing adjacent to the recesses and adapted to protrude therein. Means on the car for engaging the eccentrics in the recesses to thereby throw the switch through suitable connections.

812,595. Amusement Apparatus; Otis Roberts, Winfield, Mass. App. filed Nov. 1. 1905. A spiral ascending trackway and a descending trackway in which are incorporated a "loop-the-loop" and a "loop-the-gap."

812,597. Railway Traffic Control System; William Rowe, Marrichville, N. S. W., Australia. App. filed Feb. 23, 1905. A block-signal system, including contact plates along the track, by means of which various semaphore signals are operated and telegraphic communication had with the various stations along the route under certain circumstances.

812,725. Surface Contact System; Frank E. Case, Schenectady, N. Y. App. filed July 22, 1904. An auxiliary generator operated by compressed air, together with such circuit connections that when the generator is set in operation and the controller is moved to its first position, current passes from the generator to the operating magnets of one or more pick-up switches, causing the switch or switches to be closed, completing the motor circuit for the main line, and cutting out the auxiliary generator.

812,781. Electrically Conductive Rail-Joint and Bond Therefor; Bancroft G. Braine, New York, N. Y. App. filed April 11, 1904. The rail splice-bar had a longitudinal groove therein, which has a convex bottom and undercut side walls.

812,790. Electric Railway System; William N. Haring, Nyack, N. Y. App. fied Oct. 31, 1903. Relates to an underground conduit system having a sectional conductor, the connections of which are spring-pressed upward. When the car passes they are depressed by the collector shoe and temporarily charged by contact with the potential source.

PERSONAL MENTION

MR. D. G. EDWARDS, of Cincinnati, who was appointed general traffic manager of the so-called Widener-Elkins interurban properties in Ohio and Indiana, has been elected vice-president and director of the Cincinnati Northern Traction Company.

MR. C. H. YOUNG, of Cleveland, has been appointed general passenger agent of the Lake Shore Electric Railway, succeeding Mr. F. W. Coen, who was recently elected treasurer as well as secretary of the company. Mr. Young is traveling passenger agent of the Rock Island Railroad, and he has had considerable experience in the passenger field.

MR. E. P. CLARK, heretofore president and general manager of the Los Angeles-Pacific Railroad Company, has assigned the duties of general management of the company to Mr. T. R. Gabel, general superintendent and traffic manager. Mr. Clark, who has been actively engaged in the management of the property for about ten years, will now confine his labors to the work of the chief executive of the company.

MR. C. NESBITT DUFFY has severed his connection with the Chicago City Railway Company as secretary and auditor. Mr. Duffy has an extended and varied experience in the street railway business. He was one of the organizers of the Street Railway Accountants' Association of America, was president of the Association in 1899-1900, and is chairman of the committee on standard classification of accounts and chairman of the committee on international form of report.

MR. T. C. PENINGTON retired as treasurer of the Chicago City Railway Company at the annual meeting held last week. Mr. Penington has been connected with that company and its constituents for thirty-three years. During that time he was advanced in the service of the company by assiduous application to work, combined with natural ability in the control and management of financial affairs. In 1895 he was elected secretary and treasurer of the American Street Railway Association, the duties of which office he performed until the reorganization of the association last year as the American Street & Interurban Railway Association. Mr. Penington became well known to all attendants at the different conventions when acting as secretary and treasurer of the American Street Railway Association where his genial ways made him popular with all. His plans for the future are undecided, but he expects to continue in business.

Street Railway Journal

Vol. XXVII. NEW YORK, SATURDAY, MARCH 3, 1906. No. 9.

Published Every Saturday by the

McGraw Publishing Company

Main Office:
NEW YORK, Engineering Building, 114 Liberty Street.
Branch Offices:
Chicago: Monadnock Block.
Philadelphia: Real Estate Trust Building.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York"; "Stryjourn, London"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada, Mexico and the Canal Zone.

Street Railway Journal (52 issues)....$3.00 per annum
Single copies .... 10 cents
Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August & November) $4.00 per annum
Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy)....$6.50 per annum

To All Countries Other Than Those Mentioned Above:
Street Railway Journal (52 issues), postage prepaid.... $6.00
25 shillings. 25 marks. 31 francs.
Single copies ....20 cents
Remittances for foreign subscriptions may be made through our European office.

NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the Street Railway Journal.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires.

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal 8300 copies are printed. Total circulation for 1906 to date, 74,300 copies, an average of 8256 copies per week.

The Design of Motorman's Cabs on Interurban Cars

There has been considerable discussion at several recent meetings of interurban railway associations and in the columns of the Street Railway Journal, on the proper design of interurban cars. In this consideration of the arrangement of the car body the design of the motorman's cab has been almost completely neglected. The cab of an interurban car, however, deserves considerable attention. Interurban railway men are beginning to appreciate to a greater and greater extent the value of the floor space in a car, and, as they do so, the practice of devoting the entire front platform to the motorman is being discontinued.

On many interurban cars of recent design, a portion only of the platform is given up to the motorman. The remainder is used for baggage or for passengers.

A design of car used in some cities, as well as on certain interurban lines, seems to be a happy solution of the question. The car is intended for operation in both directions. Strictly speaking, there are no platforms as the body of the car is continued to the bumper. The motorman's cab occupies the left-hand side of the front of the car, and is separated from the rest of the car by sliding doors. Another door, from the motorman's compartment, opens outside. The rear of the car is fitted, of course, in the same way, except that the doors from the cab to the body of the car are kept open and the cab serves as an entrance into the car. A single-end car now being constructed for a large interurban system, has a similarly located cab in the front end, without the sliding doors. The motorman may enter the cab from the outside through a door of the usual type, or he may enter from the baggage compartment through a half-door, which opens to a height of only about 4 ft. from the floor.

In both of these designs, the motorman is under plain observation from the passenger compartment through the glass partitions. Some object to having the motorman in plain view of the passengers, but such a plan has its advantages. The motorman knows the eyes of the passengers are upon him, and he is therefore more likely to attend strictly to his work. Where the interior of the cab is obscured from the main compartment, there is often a tendency for the motorman to be less attentive to business than otherwise.

The size of the cab is a question deserving considerable attention. With the multiple-unit control systems, it can be made very small as is the practice on elevated roads. This has the advantage that visitors are necessarily excluded, but on long interurban runs a cramped cab is rather trying on the motorman. While there is no need of giving him the entire front of the car, yet the cab should be made sufficiently roomy to relieve its occupant of the idea that he is fastened in stocks.

A type of interurban car used on many roads has no cab proper. The motorman occupies the front of the baggage and smoking compartment. An iron-pipe railing protects him from intrusion. Sometimes this railing reaches to the roof of the car, and is made strong enough so that baggage can be piled up against it. Such an arrangement has the disadvantage that the general conversation is likely to distract the motorman's attention.

The fact that there are so many designs of cabs in use, is an indication that thought is being given to the subject of cabs in general, and no doubt in a few years there will be a general tendency to settle on one style that in practice will be found best fitted to the requirements.

Ignorance in the Winding Room

The armature is the most mysterious part of an electric-car equipment. In fact, it is about the only piece of apparatus about the shop that overawes most shop men of average intelligence. They consider it completely beyond their ability to gain a very definite idea of armature design. To be sure, the workmen understand enough about it to know how to put the coils in. This requires only a knowledge of the throw of the coils and of the throw of the leads to the right and to the left of a slot or segment taken as the starting point. But after they have completed the winding, very few have little more than a vague, hazy idea of the connections each coil makes or the path of the current through the armature when the machine is in operation. Ask the average armature winder what connections result when the top or bottom leads are laid one segment on either side of the proper position, and he is completely in the dark. Other similar questions will confuse him to a similar extent. We believe that many other winders would be completely at sea, were they given a stripped armature to wind. When stripping an armature, preparatory to rewinding it, they usually take great care to mark the position in the slots of one coil and also to mark the commutator segments to which the terminals of the coil are connected. This is their sole guide. Evidently, such had been the method of winding armatures followed in a shop where the writer encountered a General Electric 800 armature wound with a lap winding. The winder had been at the head of the department for several years, and for about a year previous to the time the armature came in for some minor repairs. In testing the armature, it was discovered that the winding lapped back on itself or, in other words, was connected for a two-pole machine. The car in which this armature belonged was noted for its speed, and had an ammeter been placed in circuit the equipment would certainly have acquired a reputation as a current consumer. Evidently, several years before, some one had made a mistake and wound the machine wrong. Ever afterwards, when it came in for repairs, the new coils were put back exactly as the old ones had lain and the armature continued to take about twice the normal current.

It must be admitted, that ignorance in the winding room costs many companies a great deal of money, and it must also be admitted that it is rather difficult to remove such ignorance. There is very little literature on street railway armature windings. In fact, there is not much to write about them. The only way for a winder to get a better knowledge of armatures is to use his imagination and a pencil. He should draw diagrams of windings with coils and leads in the proper positions, and then transpose one or two of the leads and note what connections result. He should accompany the study of the diagrams by making the same changes of connections on an armature, and then testing the armature with a lamp bank or other device.

By constant work he will finally get the connections so fixed in his mind that when he encounters an armature wound wrong he will know what is the matter with it at once. It will require patience and a great deal of time and a great deal of coaxing of the imagination, but such efforts will certainly result in a great deal of good to the workman and a great saving in winding-room expenses to the company.

Electric Railway Development in the South

It is probably true that the average Northerner does not realize what a truly remarkable country the much-heard-of "New South" really is. The uniformly good crops of the past few years, the influx of new capital and well-directed energy on the part of its own citizens, have given a new impetus to all Southern industries and activities, and this section of the country is crossing the threshold of what gives promise of being an unparalleled era of prosperity and growth. As a matter of fact, the South has grown faster than her own resources. This is true with special emphasis as regards electric railways, and the street railway managements in all of the important cities are being hard put to keep their systems up with the growth of the population and business in the communities they serve. Fortunately, virtually without exception, the roads are in strong hands, and the demands for improvements and betterments are being intelligently and consistently met.

A recent editorial visit to a few of the important Southern cities revealed an immense amount of new work in progress in the form of reconstruction and extensions of tracks, additions to power facilities and rolling stock, and the construction of new car houses and shops. Most of the development thus far has been in the strictly city properties, although the modern type of high-speed suburban road is beginning to make its appearance, as for example near Atlanta, where there is in successful service a 40-mile interurban line operated with single-phase motors.

In reviewing the electric railway developments in the South with reference to the improvements and betterments that are being carried out, a considerable number of the properties can be classified into two groups. One group, known as the Newman properties, comprises the street railway systems in Birmingham, Ala.; Little Rock, Ark.; Memphis, Tenn.; Nashville, Tenn., and Knoxville, Tenn. The other group is those properties controlled by Stone & Webster, of Boston, and includes the roads in El Paso, Dallas, Houston and Galveston, Tex.; Jacksonville, Fla.; Savannah, Ga., and Tampa, Fla. For the most part the systems in the other important cities are largely owned by local interests, but the same progressive spirit is being shown in putting them in first-class condition to meet the uniformly healthy growth of their respective communities. Atlanta, the gateway of the South from the East, has an up-to-date transportation system that within the past two or three years has been brought to a high state of efficiency by the judicious expenditure of large sums of money in extensions and betterments. New Orleans has entirely recovered from the slight set-back incident to the yellow fever scare, and has now entered upon an area of growth and prosperity that bids fair to equal, if not eclipse, any city of her class in the North or West. To an outsider visiting the city for a few days, it would seem as though New Orleans was enjoying a regulation Western boom, but the citizens of the city are quick to assure the visitor that the present commercial and industrial activities are not evidence of boom conditions, but are assurances that New Orleans, as the metropolis of the South, is but reflecting the general prosperity of the country. The street railway system of the city has had its full share of vicissitudes, but is now in the hands of a management that is keenly alive to the opportunities, and by the judicious expenditure of several millions of dollars on improvements the property is rapidly being put into condition to give the city ample transportation facilities. Justification for faith in the enterprise is already being reflected in largely increased earnings. The work which the company is doing in enlarging its power-generating supply under difficult circumstances is a particularly noteworthy engineering achievement.

No review of the street railways of the South would be complete without special mention of the little city of Galveston. Owing to the gigantic undertaking now being carried out by the city and county of Galveston, in raising the grade of a considerable area of the city from 2 ft. to 10 ft. above the old level forever to protect the city against the inroads of the sea, the street railway company has been forced to operate during the past two years under the most adverse conditions. Many of its tracks have been operated on temporary trestle-work, and in a number of cases the company has been compelled to abandon portions of its lines for months at a time in order to accommodate the grade-raising operations. Despite these obstacles, the company is showing a steady and healthy increase in gross earnings, and under normal conditions will make a record of which the management may well be proud.

It may be said without disparagement, that up to within a half-dozen years the Southern cities, as a class, were somewhat backward in taking advantage of progress in the transportation art, and, as a result, most of the new work that is now going on is being carried out with properties that are more or less antiquated as the basis. This has often introduced complications, for much of the old is still serviceable, and conservative finance does not justify its entire abandonment. Therefore, the betterment work in practically all of the cities has been in the direction of redesign, rearrangement and reconstruction, together with the addition of extensions and enlarged capacities to meet new conditions.

In track work, the tendency is, of course, toward heavier rails, although the extremely heavy sections, say of 100 lbs. and over, now so frequently recommended for cities of similar size in the North and West, are not yet used extensively in the South—undoubtedly, because the engineers do not feel that the density of the traffic warrants the extremes in weight. In the matter of ballast, aside from a few localities like Birmingham, where furnace slag is available, good track-ballast is scarce. Oyster and clam shells are widely used, and make satisfactory ballast if given a good foundation. Some of the cities, such as Atlanta, Birmingham and New Orleans, are to some extent going in for concrete construction on lines of heavy traffic. In the extreme Southern cities, where the soil is always more or less impregnated with moisture, the question of track foundation is a most serious one. The surviving tendency is toward an 80-lb. T or a 9-in. girder rail, with plenty of ties laid on 6 ins. to 12 ins. of shell or gravel ballast. If less than 10 ins. of ballast is put under the ties, it is the common practice to support the ballast on a tight, compactly-laid flooring of 1 in. or 1½-in. planking in the bottom of the trench, the idea being that this planking distributes the load evenly over the sub-foundation and prevents concentration and consequent sagging at any one point. Gravel and broken stone for ballast are very scarce and very expensive.

As regards new power-station equipment, most of the systems are taking advantage of the latest developments in generating apparatus, and many of them are putting in steam turbine driven alternating units. It is the rule rather than the exception, in the Southern cities, for the street railway and electric lighting plant to be operated under the same management, and this condition has opened up a larger field for the turbine-driven alternator. As previously stated, the systems as a rule are urban propositions and few of them would require alternating-current transmission for the street railways alone, but in conjunction with the lighting the two combined are able to secure the advantages of high-tension generation, and distribution. Texas oil is now available for fuel throughout a very large section of the South, and practically all of the power stations are fitted to burn oil under the boilers. Many of them are so arranged that either oil or coal can be burned in the same furnace, so that advantage can be taken of the relative prevailing prices of both oil and coal. Taking into consideration the prices at which oil is usually available and the steam-producing qualities of both fuels, the economy in burning oil as a substitute for coal does not come so much in direct saving per pound of combustible per pound of steam as it does in the material reduction in power-house labor and in the general convenience and cleanliness resulting from the use of oil.

Cars of the semi-convertible types are rapidly supplanting all other designs, and under the conditions prevailing in most of the cities south of Mason and Dixon's line, this type may be said to find its ideal application. For three months of the year, a complete equipment of closed cars is almost necessary, while for the remaining nine months, open cars are imperative. The semi-convertible solves the difficulty by combining the two. The short, single-truck car is still most frequently seen on the city streets, but the large double-truck car is rapidly coming into favor for heavy-traffic lines. However, the four-motor car is not yet in general favor with the Southern managers, primarily because the country, as a rule, is flat and conditions do not require speeds much in excess of 12 to 14 miles an hour. On the comparatively few long suburban lines, modern four-motor equipments have, of course, been adopted.

The crying need of all the roads visited is car house and shop room, and the designing and erection of new car housing and repair facilities is the one subject that is probably uppermost in the minds of most of the managements. The old plants, without exception, have been outgrown, and the lack in this regard is being rapidly met by the erection of new buildings. In this work, the fullest advantage is being taken of modern ideas in house and shop design and equipment, special regard being paid to reducing fire risks. Concrete car houses are being built in at least two instances. Detailed accounts of the more important improvements in progress in the South will appear in due course in this paper.

THE GRAND AVENUE STATION OF THE CONSOLIDATED RAILWAY COMPANY AT NEW HAVEN, CONN.

Like the majority of power stations serving the smaller street railway systems at the present time, the Grand Avenue power house of the Consolidated Railway Company, New Haven, Conn., was planned and built in the early days of the industry with little reference to the changes that might be wrought by the future, either in the way of extensions of old lines or consolidations with adjoining railways. From time to time it has been found necessary to add new machinery and make unusual demands on the older apparatus, so that now this station represents something very different from the original layout and operating condition. Nevertheless, despite its twelve years' service and mixed equipment, this plant is producing power at such low rates as to make well worth while a detail study of the character of its equipment and operation. This station was built by Sheaff & Jaastad, of Boston.

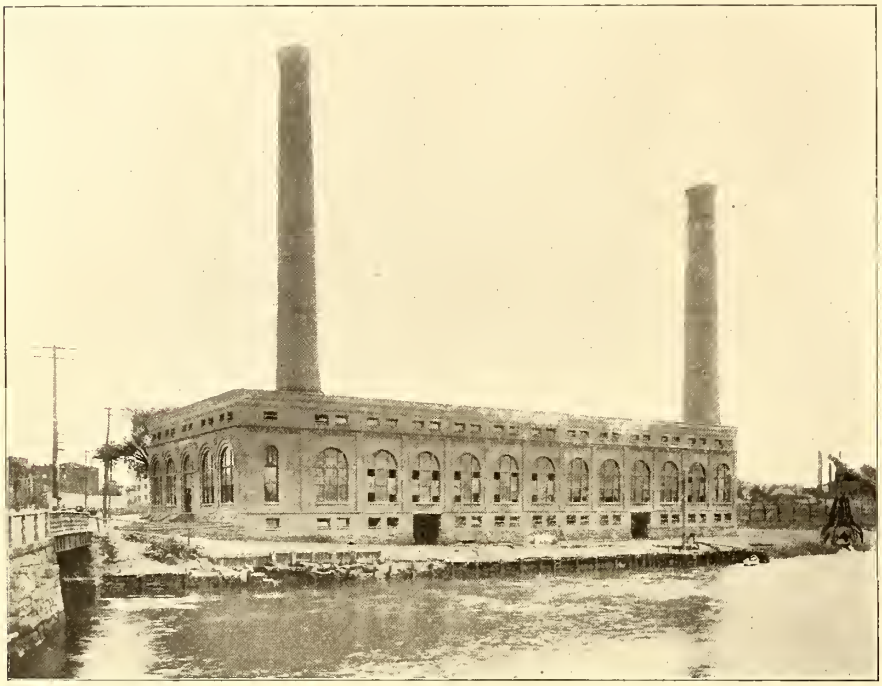


FIG. 1.—THE GRAND AVENUE STATION OF THE CONSOLIDATED RAILWAY AT NEW HAVEN, CONN., TAKEN BEFORE INSTALLATION OF COAL-HANDLING APPARATUS

LOCATION

The station faces Grand Avenue, with the Mill River on the west and the Manufacturers' Railroad on the east, thus affording excellent facilities for securing salt water for condensing purposes and for getting coal either by water or by rail. The building is constructed of brick, 199 ft. long and 78 ft. 8 ins. wide (inside measurements). Each of the two stacks is 140 ft. high, but one them has an internal diameter of 6 ft. 6 ins., and the other 9 ft. At the bottom of the rear stack a room has been built for storing paints and other dangerous materials. The boiler room, which is on one floor, is 187 ft. long, 29 ft. 8 ins. wide and 39 ft. high. The engine room is 199 ft. long, 49 ft. wide and 29 ft. high. The basement is 10 ft. in height. The shorter length of the boiler room allows room for the chief engineer's office in the front part of the power house.

BOILER-ROOM EQUIPMENT

The boiler room contains nineteen hand-stoked, vertical, fire-tube, Manning boilers, ten of which are 125-hp and nine of 200-hp each. The working steam pressure is 120 lbs. per square inch. Each of the 125-hp boilers has 188 2½-in. tubes, and the 200-hp boilers 284 tubes of the same diameter. The heating service of each of the small boilers is 1950 sq. ft., and the grate area 28 sq. ft., while the corresponding figures for the large boilers are respectively 2918 sq. ft. and 38 sq. ft. The total heating surface of all the boilers is therefore 45,782 sq. ft., and the grate area 631 sq. ft. The grates are stationary, with ⅝-in. openings. The feed-water supply is taken from the New Haven city system through one 4-in. and two 6-in. metered mains. The boiler feed-pumps, all of which are operated by steam, comprise two single double-acting Knowles pumps, 10 ins. x 10 ins. x 4 ins.; one Dean duplex pump, 12 ins. x 7 ins. x 10 ins.; and one Carpenter duplex pump, 12 ins.

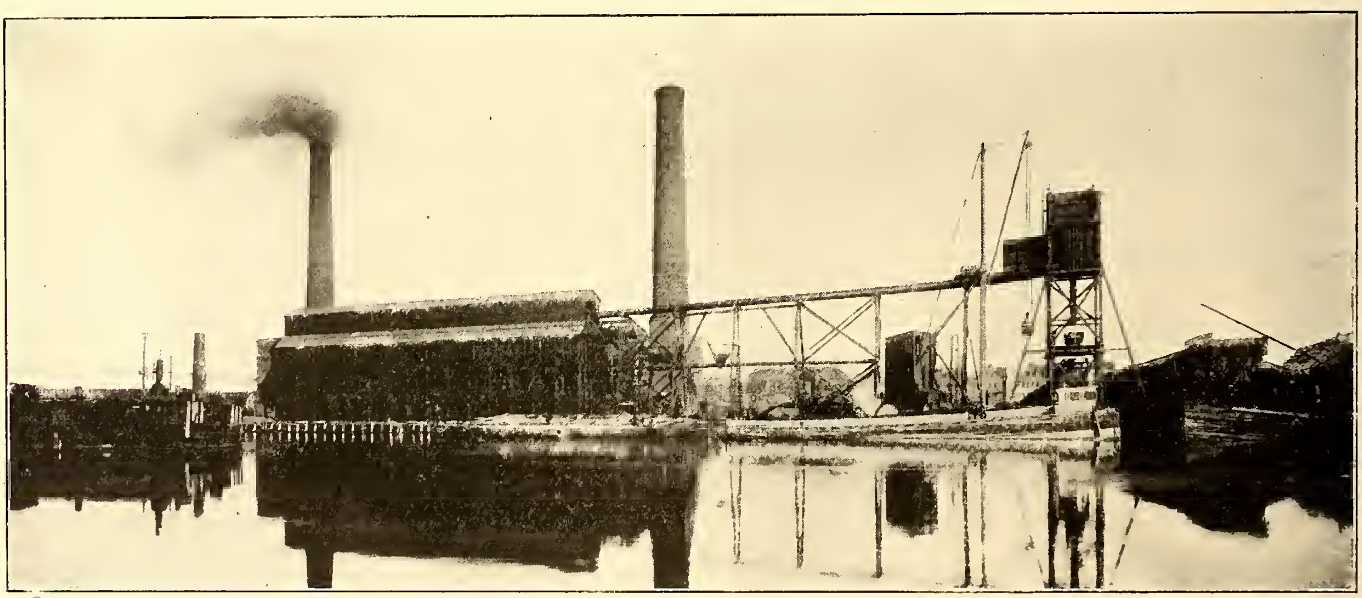


FIG. 2.—REAR VIEW OF THE GRAND AVENUE POWER STATION, SHOWING THE MAST AND GAFF HOISTING OUTFIT AND AUTOMATIC RAILWAY FOR HANDLING THE COAL SUPPLY

x 6 ins. x 10 ins. In addition, there is one 2-in. Metropolitan injector. There are eight primary coil heaters and one auxiliary coil heater. The steam main is 12 ins. in diameter. All of the valves in the plant are of the Chapman extra heavy pattern, No. 43.

ENGINES AND GENERATORS

The oldest units in the station are three 275-kw, 8-pole, 500-volt Westinghouse generators running normally at 92 r. p. m. These machines have been in service for twelve years, or since the opening of the station. When some of the lines were extended it was found that with 500 volts at the bus-bar the drop in transmission was so great as to interfere seriously with the schedule. By speeding up the generators, however, it was found that they could be made to give 550 volts, and they are still frequently worked at this higher voltage with very satisfactory results. Like all the later electrical apparatus in this station, these first machines are able to carry 25 per cent overloads for long periods without injury. They are direct connected to three horizontal cross-compound Allis engines, 16 ins. x 30 ins. x 36 ins., rated 350-hp each, and require a floor space of 380 sq. ft. per unit. The two cranks of each of these engines are placed at an angle of 90 degs. Corliss valves are used. The ratio of the cylinders is 3½ : 1; the diameter of the piston rod, 2⅝ ins.; length of the connecting rods, 9 ft.; length of the shaft, 15 ft. 10 ins.; diameter of the shaft, 16 ins.; bearings, 13 ins. x 19 ins. The fly-wheel is 16 ft. in diameter, and has governors of the centrifugal ball type. The steam pipes are 4 ins., and the exhaust pipes 12 ins. in diameter. Each engine has an independent Allis-Chalmers jet condenser, 8 ins. x 10 ins. x 17 ins.

The two 525-kw General Electric generators were installed about six years ago. They are normally 550-volt machines, but frequently give 600 volts. They have 10 poles, and when giving 550 volts have a speed of 80 r. p. m. These generators are direct connected to two vertical cross-compound Allis engines, 23 ins. x 48 ins. x 48 ins., rated at 750-hp each, and occupying a floor area of 307 sq. ft. per engine. Each has two cranks set at an angle of 90 degs. As on the 350-hp engines, Corliss valves are used. The ratio of the cylinders is 4¼ : 1; diameter of the high-pressure piston rods, 3⅞ ins.; low-pressure piston rods, 4⅝ ins.; length of the connecting rods, 11 ft.; length of the shafts, 19 ft.; diameter of the shafts, 20 ins.; bearings, 18 ins. x 36 ins. The fly-wheels are 18 ft. in diameter, and the governors are of the centrifugal ball type. The steam pipes are 7 ins., and the exhaust pipes 16 ins. in diameter. Each engine has an independent jet condenser, 12 ins. x 12 ins. x 26 ins.

FIG. 3.—THE BOILER ROOM

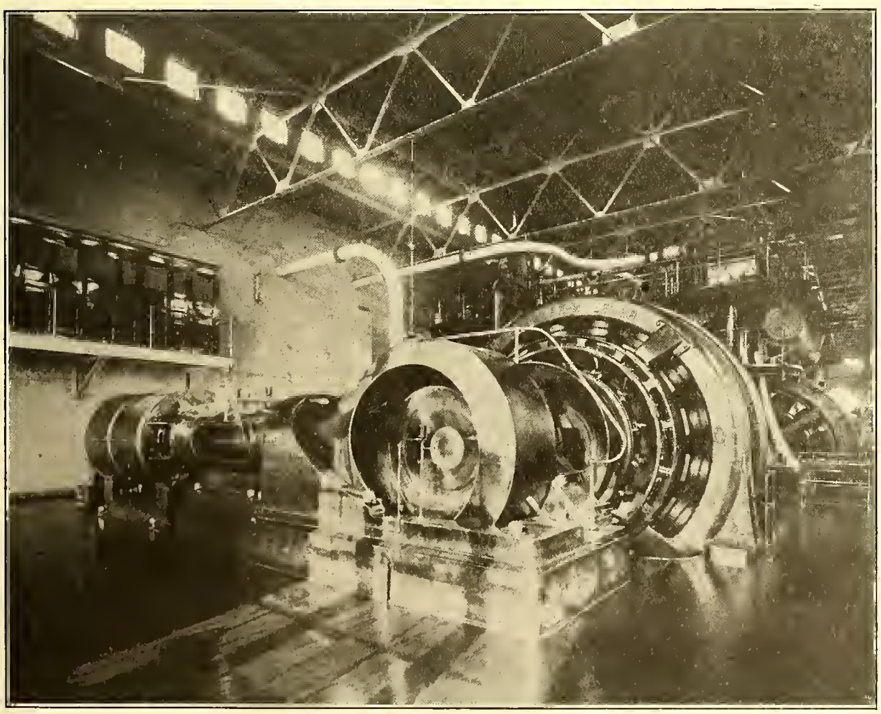


FIG. 4.—THE 900-KW GENERATING SET RECENTLY INSTALLED IN THE GRAND AVENUE POWER STATION, NEW HAVEN, CONN.

The two 800-kw, 550-volt General Electric generators have been in service for about five years and are also operated, when necessary, at 600 volts. They have 14 poles, and when giving 550 volts have a speed of 80 r. p. m. Direct connected to these machines are two vertical cross-compound Allis engines, 26 ins. x 52 ins. x 48 ins., rated at 1000-hp each, and requiring a floor area of 307 sq. ft. per engine. Each engine has two cranks placed at an angle of 90 degs., and is furnished with Corliss valves. The ratio of the cylinders is 4 : 1; the diameter of the high-pressure piston rods, 3⅞ ins.; low-pressure piston rods, 4⅝ ins.; length of the connecting rods, 11 ft.; length of the shaft, 19 ft., and diameter of the shaft, 20 ins.; bearings, 18 ins. x 36 ins. The fly-wheels are 18 ft. in diameter. The governors are of the centrifugal ball type. The diameter of the steam pipes is 8 ins., and of the exhaust pipe, 18 ins. Each engine is connected to an independent Allis jet condenser, 14 ins. x 14 ins. x 28 ins. No difficulty is experienced in procuring a vacuum of 24 ins. to 26 ins. with these condensers, even under overloads.

The latest and largest unit is a 900-kw standard Crocker-Wheeler railway generator, which was placed in service during May of last year, and it is therefore supplied with the patented brush holder, which is one of the characteristics of the direct-current machines built by the Crocker-Wheeler Company. There are only nine volts per bar on the generator, and consequently the machine is remarkably free from flashing over. The operating efficiencies are given as follows:

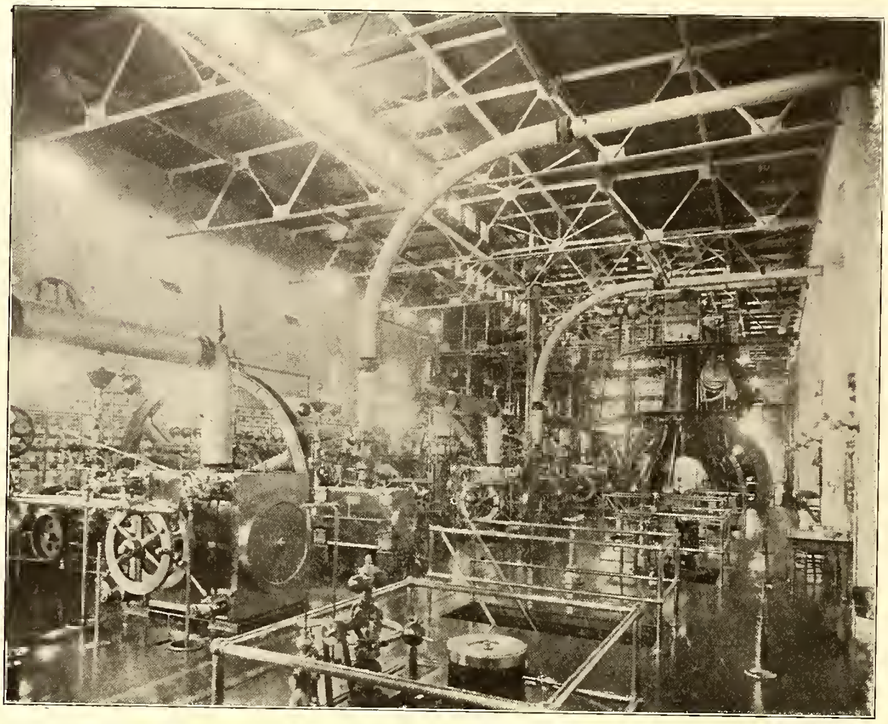


FIG. 5.—VIEW OF NORTHERN END OF ENGINE ROOM AS SEEN FROM THE ENTRANCE ON GRAND AVENUE

FORM C RY 47.

THE CONSOLIDATED RAILWAY COMPANY

POWER HOUSE--Station A.

Watch .... to 190

	STARTED.	STOPPED.	RUN.
Engine No. 1.			
Engine No. 2.			
Engine No. 3.			
Engine No. 4.			
Engine No. 5.			
Engine No. 6.			
Engine No. 7.			
Engine No. 8.			

Water Meter, No. 1. Cubic Feet

" " No. 2. " "

" " No. 3. " "

Coal Used, Tons, Pounds.

Coal Ordered, Tons.

Watt Meter, No. 1.

Watt Meter, No. 2.

Watt Meter, No. 3.

REMARKS:

Engineer in Charge.

FIG. 7.—FORM OF REPORT MADE OUT BY ENGINEER IN CHARGE ON ENGINE TIME AND WATER, COAL AND CURRENT CONSUMPTION

FORM C RY 240.

POWER STATION LOG SHEET

Consolidated R. R. CO.

DAY ENDING MIDNIGHT Jan 9, 1906.

Grand Ave POWER STATION A

BOILER Number	BOILER In Service Hours	BOILER Banked Fire Hours	ENGINE Number	ENGINE Started	ENGINE Stopped	ENGINE Engine Hours	GENERATOR Number	GENERATOR Cut in	GENERATOR Cut out	GENERATOR K.W. Hours
1	24		1				1			
2	24		2				2			
3	24		3				3			
4	24		4	5:45AM 4:55PM	12:30AM 8:45AM 9:20PM	12-55	4	5:45AM 4:55PM	12:30AM 8:45AM 9:20PM	
5	24		5	6:AM	7:40PM 12:PM	13-40	5	6 AM.	7:40PM 12:PM	
6	24		6	5:20AM	3:AM	21-40	6	5:20AM	3.AM	
7	24		7	3:AM	1:15AM	22-15	7	3:AM	1:15AM	
8	17½		8	5:35AM	12:40AM	19-15	8	5:35AM	12:40AM	
9	24		9				9			
10	19½		10				10			
11	24		11				11			
12	24		12				12			
13	24		13				13			
14	24		14				14			
15	24						TOTAL			
16	24									
17	24									
18	24									
19	24									
20										
21										
22										

FUEL CONSUMED

COAL, BITUMINOUS,	POUNDS	136,152
" BUCKWHEAT, NO 2	"	
" " NO. 3	"	
SPARKS	"	
WOOD	CORDS	

WATER TURBINE

Number	Started	Stopped	Hours Run
1			
2			
3			
4			

OIL AND WASTE

ENGINE	GALS.	13
CYLINDER	"	9.5
CRANK CASE	"	
DYNAMO	"	
KEROSENE	"	
GREASE	POUNDS	
WASTE, WHITE	"	
" COLORED	"	
RAGS	"	126. 130

K. W. HOURS BY STATION RECORDING WATTMETERS

Number	Reading Midnight Yesterday	Reading Midnight To-day	Difference	Constant	K. W. HOURS Power	K. W. HOURS Light
1	19,423,600	19,463,720	40,120	1	40,120	
2	198,100	198,100		1		
3	2,184,950	2,196,560	11,610	1	11,610	
4						
5						
TOTAL			51,730		51,730	

WATER METER READINGS

Num.	Midnight Yesterday	Midnight Today	Cubic Feet	
1	12,683,410	12,698,540	15,130	
2	4,002,329	4,002,527		192
3	448,535	454,835	6,300	
4				
TOTAL			21,430	192

REMARKS: Only water through meters 1 and 3 is chargeable to the generation of power as No. 2 meter is for washing boilers and toilet only. Maximum load was 6300 Amp's. at 6.30 P. M.

CORRECT

CHIEF ENGINEER

FIG. 6.—FAC-SIMILE OF POWER STATION DAILY LOG SHEET

Full load, 93.5 per cent; three-quarter load, 93 per cent; one-half load, 92 per cent. The generator is a 16-pole machine, giving 600 volts at 102 r. p. m. It is direct connected to one horizontal cross-compound Buckeye engine, 26½ ins. x 50 ins. x 40 ins., rated at about 1400 hp. The floor space occupied by this engine is 957 sq. ft. The two engine cranks are placed at an angle of 90 degs.; piston valves are used; ratio of the cylinders, 3½ : 1; diameter of the high-pressure piston rod, 4⅝ ins., and of the low-pressure piston rod, 6½ ins.; length of the connecting rod, 11 ft.; length of the shaft, 22 ft., and diameter of the shaft, 26 ins. The bearing is 17 ins. x 30 ins.; diameter of fly-wheel, 15 ft., and weight of fly-wheel, 20 tons. The governors are of the spring or shaft type. The diameter of the steam pipe is 10 ins., and of the exhaust pipe 18 ins. This engine has an independent jet condenser of the Warren twin-cylinder pattern, with the steam cylinders 14 ins. x 21 ins., and the water cylinders 32 ins. x 21 ins. Both the engine and generator were installed by Westinghouse, Church, Kerr & Co., New York.

The oiling system used for the machinery hereinbefore described is of the gravity type, and has a storage capacity of 25 barrels. It was designed and installed by the chief engineer of the plant, L. A. Farnham. The entire cost of the installation was only $1,725, but it has effected a saving of fully $3,640 a year, as Mr. Farnham was enabled to dispense with the services of five oilers at $14 a week. The maintenance cost has been practically nothing during the four or five years' service of this system, although even the oil pumps were simply old Knowles drip pumps, whose water cylinders were bored out and fitted with metallic valves to make them suitable for pumping the oil.

SWITCHBOARD

The switchboard is typical of the many other changes made in this plant. The original board consisted of eight panels, and was placed in a convenient alcove about 20 ft. long, but the various additions to the power equipment made it necessary to move the board forward on three occasions without interfering with the operation in any way. The present board, which is of white marble, contains eight machine panels and thirty-two feeder panels, the latter having two feeders on each panel. It is hand-operated and furnished with the usual apparatus, except that no instruments are provided for separately measuring the output of each generator. As stated before, the original 500-volt machines are sometimes run to give 550 volts, and the 550-volt machines to give 600 volts. There are, therefore, three bus-bars, one for each of the voltages mentioned, so that various combinations can be made when it is necessary to supply higher voltage to some line carrying heavier loads than usual, caused by crowds moving to the Yale athletic grounds or the popular local park, Savin Rock.

OPERATING METHODS AND STATISTICS

A most interesting feature of the operation of this plant is the exactness with which the records have been kept ever since it was started. These records have contributed in no small measure toward making improvements and in comparing the relative values of different men, machines and materials. In more than one instance the log book of the station has also been of great help in adjusting damage suits, as the switchboard reports show whether any electrical disturbances occurred on any of the lines at the time claimed. The information incorporated in the log book is derived from the attendants in charge of the boilers, engines, switchboard, etc., who make out their reports on the forms reproduced herewith.

A fac simile of the log sheet of this station for Jan. 9 is given in Fig. 6. It will be seen on examining the sheet that it reveals the exact number of hours and minutes the different boilers and generating sets were in service; the amount of fuel consumed; gallons of oil and weight of waste used; the kw-hours registered by the recording wattmeters; the water meter readings in cubic feet, and space for remarks, such as statements regarding the time of maximum loads, division of charge for water used, etc. One of the forms used to make up part of the record for the daily log is reproduced in Fig. 7. This report is made out by the engineer in charge, and covers the work for a given period of the engines, water meters, wattmeters and the coal consumption. The engineer in charge also registers the feed-water temperature every half hour on the form reproduced in Fig. 8. Electrical troubles on the outside lines noted at the station switchboard are reported on the form shown in Fig. 9. All requisitions to the storekeeper are

Form C Ry 46.

THE CONSOLIDATED RAILWAY COMPANY.

Power House, Station A.

TEMPERATURE OF FEED WATER.

12 to 12	190
12—30	6—30
1	7
1—30	7—30
2	8
2—30	8—30
3	9
3—30	9—30
4	10
4—30	10—30
5	11
5—30	11—30
6	12

_______________ *Engineer in Charge.*

FIG. 8.—FORM EMPLOYED FOR RECORDING FEED-WATER TEMPERATURE EVERY HALF HOUR

Form C. Ry. 138.

THE CONSOLIDATED RAILWAY CO

REQUISITION ON STOREKEEPER. NO. ________

DATE ________

TO STOREKEEPER:

PLEASE DELIVER TO BEARER THE FOLLOWING:

QUANTITY	DESCRIPTION		

TO BE USED FOR ________

________ FOREMAN.

CHARGED TO % NO. ________

FIG. 10.—STANDARD REQUISITION BLANK FOR POWER-HOUSE SUPPLIES

Form C. Ry. 132.

THE CONSOLIDATED RAILWAY COMPANY.

STATION A. ________ 190

Circuit Breaker No. ________ Opened. ________

Line Section. ________

From What Cause. ________

Length of Time Out. ________

Reported by ________

Reported to ________

Engineer in Charge. ________

REMARKS ________

FIG. 9.—FORM FOR RECORDING ELECTRICAL TROUBLES NOTED AT THE SWITCHBOARD

Bin No. .... Article ....

RECEIVED					USED						
Date Received	Order No.	Quantity	Price		Date Used	Requisition No.	Quantity	Price	Amount		% No.

FIG. 11.—CARD USED FOR RECORDING SUPPLIES USED

made out on the requisition blank represented by Fig. 10. As will be noted, the foreman must state for what purpose the material is to be used, this information enabling the keeper of the log book to charge the item under the proper account. Fig. 11 shows the card used in the card index system for keeping track of material received and used.

The accompanying tables have been prepared from the detail figures in Mr. Farnham's log book. It will be seen therefrom that the costs for power are very low considering the size and equipment of the plant, and the fact that they are based on the use of bituminous coal costing $3.75 per ton. Under a new arrangement, coal will no longer be carted to the station, but will be delivered in boats at the pier adjacent to the power house, carried to the bunkers via an automatic railway, and then transported over the industrial railway running in front of the boilers. The saving in carting expenses will amount to 40 cents per ton, and, of course, will reduce still further the cost of power. The new coal-hoisting machinery was installed by Westinghouse, Church, Kerr & Company, of New York. In the second table are given the exact cost per kw-hour of wages, fuel, water, lubricants and waste, maintenance, repairs, etc. The total costs of these items are entered in the log book and charged to the account numbers specified in the 1899 edition of the standard form of accounting report adopted by the Street Railway Accountants' Association of America.

TABLE I.—GENERAL DATA COVERING THE OPERATION OF THE GRAND AVENUE POWER STATION OF THE CONSOLIDATED RAILWAY COMPANY FOR THE LAST SIX MONTHS OF 1905

	July	Aug.	Sept.	Oct.	Nov.	Dec.
Total kw. output	930,000	1,046,300	1,050,400	1,114,400	1,282,000	1,395,300
Average kw. per day	30,000	33,752	35,013	35,948	42,760	45,010
Total hp.	1,246,649	1,402,546	1,408,043	1,467,024	1,718,496	1,870,375
Average hp. per day	40,214	45,234	46,935	44,098	57,283	60,335
Lbs. water used	28,510,625	29,413,750	29,083,750	30,931,875	35,352,500	36,353,125
Lbs. coal used	2,800,000	3,004,480	2,840,320	2,878,400	3,375,680	3,609,054
Lbs. water per lb. coal	10.1	9.8	10.2	10.7	10.47	10.07
Lbs. water per hp	22.8	20.9	20.6	21.08	20.5	19.4
Lbs. coal per hp	2.2	2.1	2.01	1.9	1.9	1.9
Cost per kw. for operation	.0074	.0074	.0060	.0064	.0061	.0058
Cost per hp. for operation	.0055	.0055	.0049	.0049	.0045	.0043
Lbs. water per kw	30.67	28.1	27.6	27.75	27.5	26.
Lbs. coal per kw	3.01	2.8	2.7	2.58	2.6	2.58

TABLE II.—COST, IN DOLLARS, PER KW-HOUR OF VARIOUS ITEMS DURING THE LAST SIX MONTHS OF 1905

	July	Aug.	Sept.	Oct.	Nov.	Dec.
Wages charged to account 10	.00178	.00163	.00157	.00154	.00131	.00135
Fuel for power, account 11	.00504	.00485	.00464	.00432	.00431	.00386
Water for power, account 12	.00036	.00027	.00026	.00028	.00024	.00024
Lubricants and waste, account 13	.00025	.00033	.00021	.00018	.00014	.00022
Miscellaneous supplies and expenses, account 14	.00010	.00048	.00014	.00011	.00010	.00009
Maintenance of steam plant, account 4	.00001	.00011	.00000	.00003	.00003	.00003
Total cost per kw-hour	.0075	.0076	.0068	.0065	.0061	.0058

Taken all in all, this station presents an excellent example of the good results that can be achieved even in an old plant by keeping such close track of every item entering into its operation that the slightest variations in cost and efficiency will be made apparent immediately, and thus tend toward the early elimination of all needless expenses.

TESTING OUT CONDENSER WATER-PIPES

The following describes a simple and effective test used by H. S. Cooper, general manager of the Galveston Electric Company, of Galveston, Tex., for making sure that the intake pipe that supplies water to the condensers is not becoming filled up with incrustations or sediment sufficiently to materially limit the flow of water. The Galveston station takes salt water for condensing purposes from a bay through a 10-in. iron pipe, which is about 3700 ft. long. Despite strainers and screens and other precautions at the intake end the suction draws up a large amount of oyster and barnacle spawn and spats, and these in the course of the journey to the condenser attach themselves to the inside of the pipe and build their shells, forming a hard, crustaceous lining that unless watched might gradually reduce the carrying capacity of the pipe.

As a precautionary measure, it is the practice to periodically determine the inside diameter of the pipe by inserting at the intake end copper balls of different sizes, and allowing them to be drawn through the pipe by the force of the water. The copper balls used in the test have very thin shells, so they will crush if they become lodged and will not injure the pipe. It is usual to start the test with a 2-in. ball, then follow with a 2½-in. ball and so on, utilizing balls of larger diameters. As the balls come up at the condenser end of the pipe they are carefully examined for traces of scratching. When the marks on the balls of the larger sizes begin to give evidence of having scraped against the incrustations, the diameter of the largest ball passed through is taken as the minimum size of the opening through the pipe. In this way the actual condition of the pipe can be noted from time to time.

If no other balls are obtainable for the test, copper balls borrowed from steam and water traps in the power house may be utilized, and they can be replaced on the traps as their passage through the condenser pipe does not injure them. It is the practice to turn live steam from the boiler back through the intake pipe before beginning the ball test.

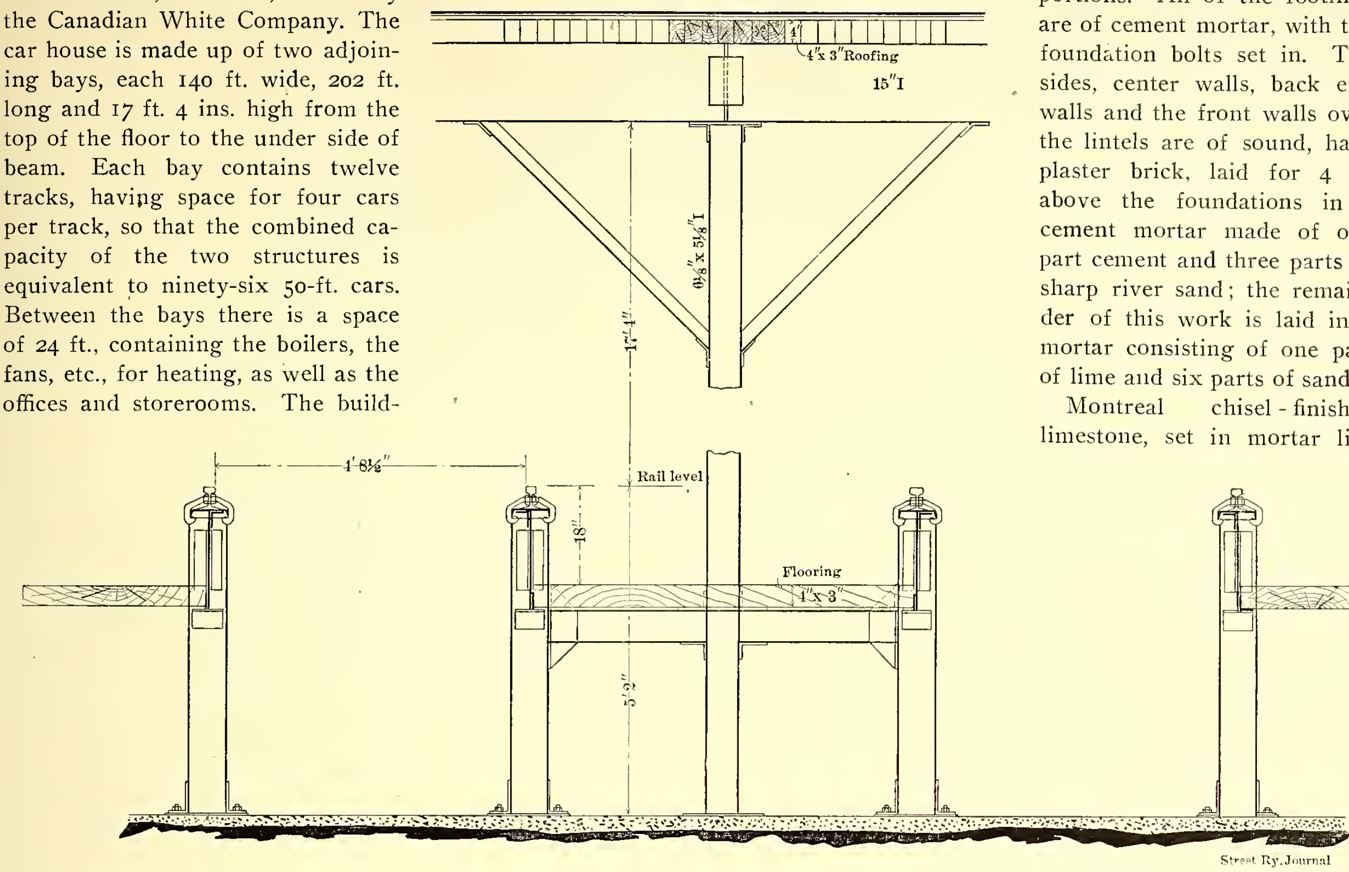
The station is equipped with Worthington jet condenser. The pumping plant for pumping condensing water is located on a wharf near the intake end of the pipe, as it is found easier to force the water through so long a pipe rather than to draw it through by suction. The pumping outfit consists of a Westinghouse type C induction motor, driving through gears a 10-in. x 12-in. 3-piston Blake pump. At the power house the intake pipe ends in a closed tank provided with screens on the inside, which serve to prevent any loose shells from being carried over into the condenser.

As a means of killing the live crustation-forming spats that are drawn into the pipe, the experiment is being tried of feeding creosote in minute drops into the condensing water at a point just inside the intake end. This is accomplished by means of an ordinary injector lubricator, set to feed the creosote drop by drop into the pipe. The creosote is having the effect of killing the spats before they form their shells.

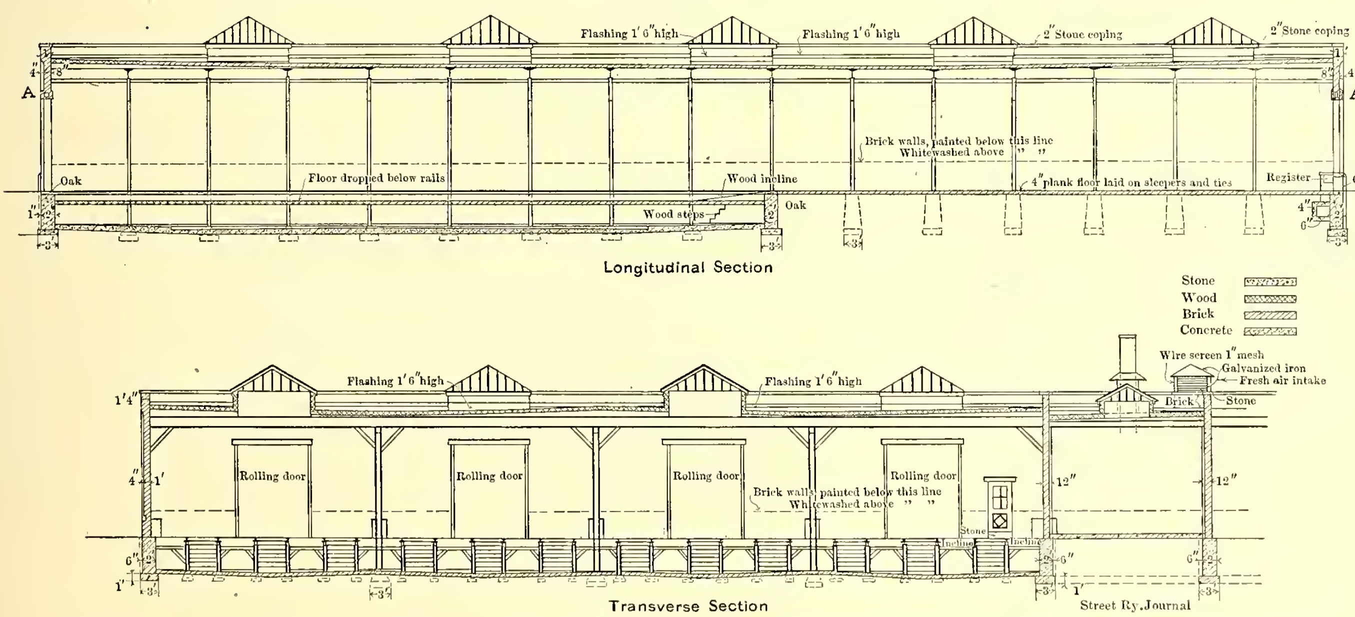
In spite of the nature of the condensing water, the operation of the plant has never been interrupted from trouble in the condensing system, and the station log shows a mean vacuum of approximately 28½ ins. gaged at the engines.

THE NEW CAR HOUSE OF THE MONTREAL STREET RAILWAY COMPANY

The Montreal Street Railway Company has recently placed in service a new car house on De Fleurimont Street, near St. Dennis Street, Montreal, erected by the Canadian White Company. The car house is made up of two adjoining bays, each 140 ft. wide, 202 ft. long and 17 ft. 4 ins. high from the top of the floor to the under side of beam. Each bay contains twelve tracks, having space for four cars per track, so that the combined capacity of the two structures is equivalent to ninety-six 50-ft. cars. Between the bays there is a space of 24 ft., containing the boilers, the fans, etc., for heating, as well as the offices and storerooms. The buildings were designed to combine the advantages of a practically fireproof construction, a quick clearing of the car houses in case of fire, and the possibility of easily inspecting cars and making light repairs to them.



ARRANGEMENT OF PIT FRAMING AND ROOFING IN MONTREAL SHOPS



LONGITUDINAL AND TRANSVERSE SECTIONS OF THE DE FLEURIMONT STREET CAR BARN OF THE MONTREAL STREET RAILWAY COMPANY

The foundations, which are on rock, extend to the rail level. They consist of a machine-made mixture of one part of Portland cement, three parts of sharp river sand and five parts of clean broken stone, the whole showing a minimum tensile strength of 125 lbs. per square inch. The piers for the posts and track iron work in the pits, as well as the bottom floor of the buildings, are made of concrete cement of the same proportions. All of the footings are of cement mortar, with the foundation bolts set in. The sides, center walls, back end walls and the front walls over the lintels are of sound, hard plaster brick, laid for 4 ft. above the foundations in a cement mortar made of one part cement and three parts of sharp river sand; the remainder of this work is laid in a mortar consisting of one part of lime and six parts of sand.

Montreal chisel-finished limestone, set in mortar like that for the brickwork, is used for the water table course, door and window sills, lintels and the skewbacks over the windows. The walls of the structure are of plastic hard-burned brick, while the facing in the front elevation is of No. 3 red pressed brick, the bricks being laid so that every seventh course is made up of headers. The copings are laid with a pitch to the roof. All posts, including the roof supports, rafters and pit supports, are of steel. The floors and platforms between the tracks are of 4-in. x 3-in. pine, laid 4 ins. thick and lowered 18 ins. below the top of the rail for the front half of each building. This construction permits the cars to be inspected more easily, and allows repairs to be made to springs, side, rods, etc., without requiring a pit. One of the most interesting features in connection with the pit work is in the method adopted to prevent the rails from spreading. As tie-rods would, of course, have been impracticable, it was determined to prevent spreading by clamping the rails, as illustrated. It will be seen that every rail is secured on either side of the web by a clamp, which is turned in under the supporting channel beam, the opposite clamps being bolted together.

The floors in the pits slope slightly to the center of each third track to a shallow longitudinal drain leading to a central drain slightly nearer the back end of the shop, thence into a cross drain leading into a catch basin, from which it passes into the main city drain on St. Denis Street.

The roof, which is calculated for a load of 75 lbs. per square foot, is supported on steel beams. It consists of 3-in. x 4-in. spruce, laid and spiked together on edge, which makes a solid roof 4 ins. thick, covered with 1-in. spruce boards, grooved and tongued, and laid pitching to gutters down the line of posts in the center, the whole being properly drained by pipes leading to the drain in the building. The inside of the roof is covered with fireproof paint. The roof covering consists of a five-ply 8-oz. composition of tar and gravel roofing.

The walls, skylights, fresh-air inlet and all other places where required are flashed with galvanized iron. The skylights are made of galvanized iron reinforced with iron rods set in a wooden curb and glazed with obscure glass of double thickness. These skylights serve both for lighting and ventilation. All outside and inside woodwork was painted with three coats of lead and oil, while for the interior brick work two coats of bronze green were applied to a height of 4 ft., the remaining distance to the roof being whitewashed. The car doors and fire doors are of the Kinnear rolling shutter type, operated by hand. For the door sills, 4½-in. x 12-in. oak beaks are used. These are secured to the top of the concrete with countersunk bolts.

The heating and ventilating system used in these car houses was supplied by the B. F. Sturtevant Company, of Hyde Park, Mass. It is capable of changing the air in the bays four times an hour and heating the building to 70 degs. F. in zero weather. The main hot-air ducts leading from the fans are of concrete, and those under the floors of galvanized iron.

HOME-MADE HYDRAULIC PIT JACK AT KANSAS CITY

G. J. Smith, master mechanic of the Kansas City Railway & Light Company, has built some hydraulic pit jacks for lifting motors and armatures, which are illustrated herewith. Fig. 1 shows the jack alone, while Fig. 2 shows the jack in the pit and also the type of pit construction employed. The jack has a piston 3 ins. in diameter, with a pump piston or ram 1¼ ins. in diameter. The lift piston is packed with a cup leather, and the pump piston with the ordinary piston packing. In Fig. 1, the pump is seen at the right, and the valve, to stop the piston in any position, is seen at the left.

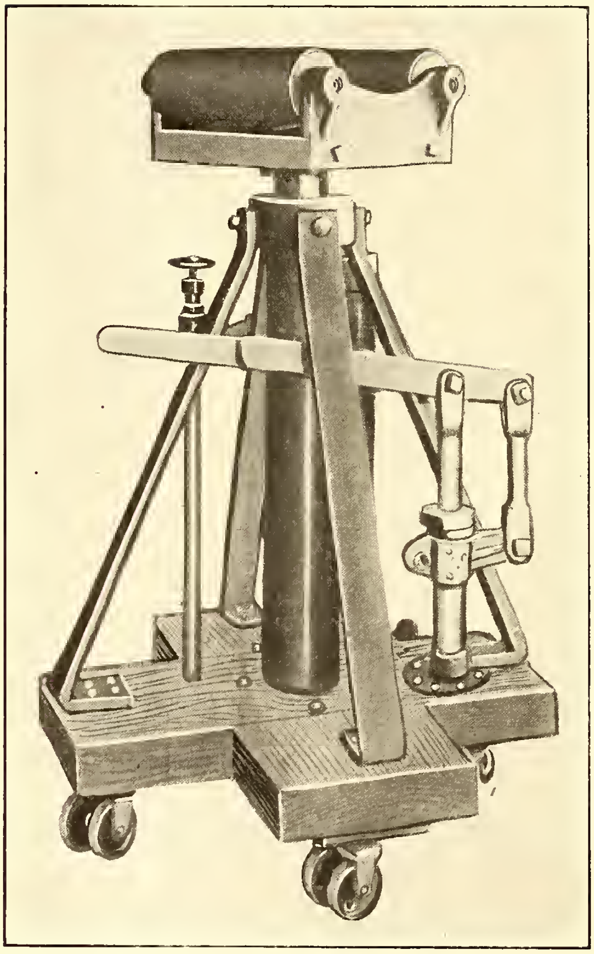


FIG. 1.—HYDRAULIC LIFT USED IN KANSAS CITY

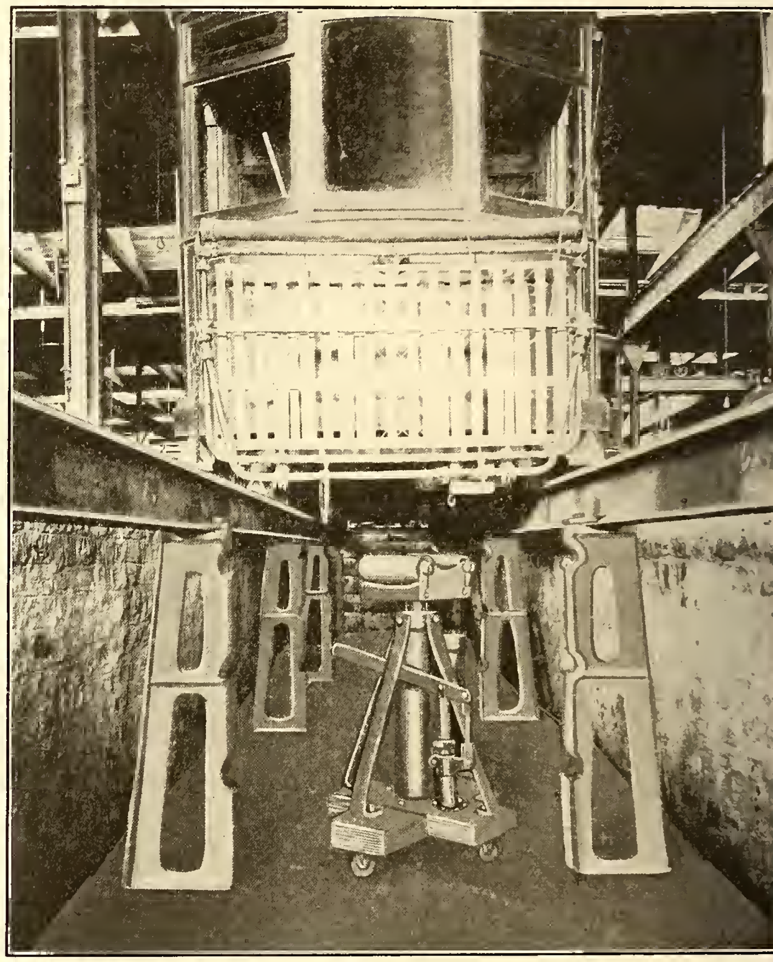


FIG. 2.—PITS AND HYDRAULIC LIFT AT KANSAS CITY

The pits used in Kansas City, as seen by Fig. 2, are very wide, so as to leave a space outside of each track rail, as described in a previous issue of the Journal. The tracks are supported on cast-iron pillars.

The hydraulic jack is found superior to mechanical jacks, because very small movements can be obtained with it.

SOME FEATURES OF THE TICKET SYSTEM OF THE INDIANA UNION TRACTION COMPANY

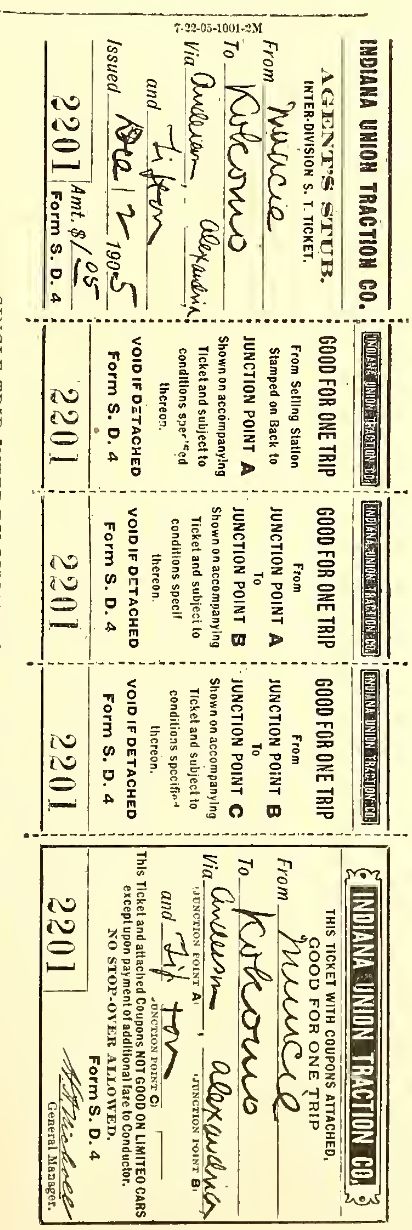
In devising a ticket system for the Indiana Union Traction Company there were several conditions to be met and considered not often encountered on other interurban roads. The different divisions of this system intersect at several junction points. To travel from some portions of the system to others, it is necessary to change cars four times when passing through such junctions. As it was highly desirable to have the conductor on each car collect either a ticket or coupon from each passenger, a through ticket from one extreme point on the system to another must necessarily have several coupons attached to it. Were coupon tickets employed having the destination and junction points and selling station printed in the proper places, so many varieties of tickets would be required that several inconveniences would result. There are, in fact, about fifty stations on the system, and when the number of different forms is considered that would be necessary in order to supply each station with printed tickets to every other station, a system having tickets printed in full is at once seen to be out of the question.

Again, if the selling agent is compelled to fill out the body of the ticket, the agent's stub and each coupon, the work not only requires considerable time, but mistakes are likely to be of frequent occurrence. The time required to fill out such a skeleton ticket is, however, the greatest drawback to its use on electric railways, and especially is this the case on the Indiana Union Traction Company's system. From Anderson, for instance, every two hours trains leave over three divisions at the same time. Were a ticket used which required several blank places to be filled in, extra help would have to be supplied the agent at this point just before these three trains left. The same conditions are found at other junction stations.

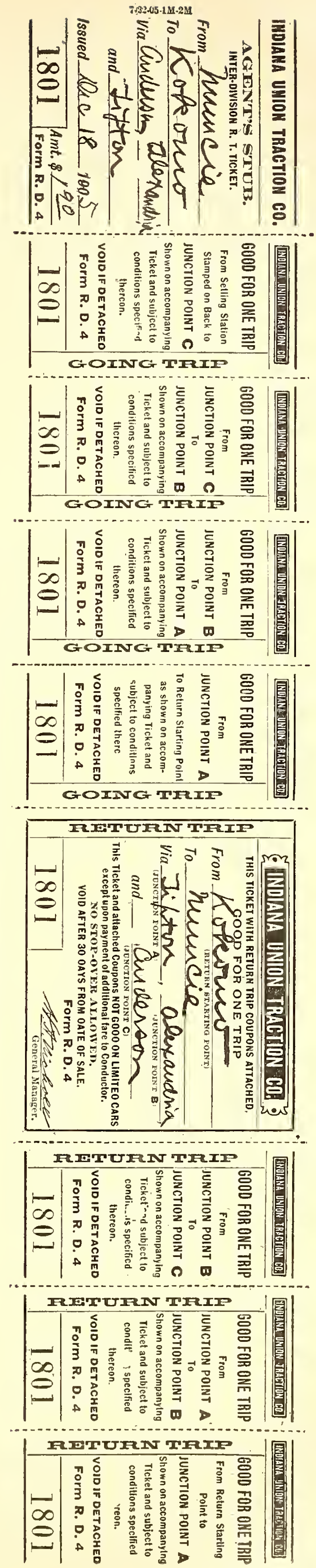
The inter-division ticket in use was gotten up by S. R. Dunbar, passenger agent of the system. It avoids to a very great extent the objections referred to, yet retains all of the essential features of a skeleton form of coupon ticket.

One of the most complicated forms of the inter-division ticket is reproduced. It is a round-trip ticket over four divisions. It consists of the ticket proper, the agent's stub, four "going-trip" coupons and three "return-trip" coupons. The limited amount of filling in that is required of the selling agent is at once observed. This ticket is shown filled in for a round trip from Muncie to Kokomo. The selling agent, after filling in the blanks, removes the agent's stub. The conductor on the Indianapolis-Muncie division removes the first "going-trip" stub. The body of the ticket makes evident to the conductor the destination and route of the passenger. At Anderson the passenger changes to a car on the Indianapolis-Muncie division, and the conductor removes the next going-trip stub. The remaining going-trip stubs are removed by the conductors on the Alexandria-Tipton and the Indianapolis-Logansport divisions. On the return trip the remaining stubs are taken up by the conductors, and finally the conductor on the Indianapolis - Muncie division takes the ticket proper. It will at once be seen that each conductor has something to show that he has carried the passenger over his division.

After the stubs and ticket are turned in, the similar numbers on all of them permit of a comparison, and the junction points "A," "B," "C" may be identified for each of the stubs. While at first glance this round-trip form of ticket is somewhat confusing, by following the reading matter on each stub it may be seen that the



SINGLE TRIP INTER-DIVISION TICKET, OVER FOUR DIVISIONS

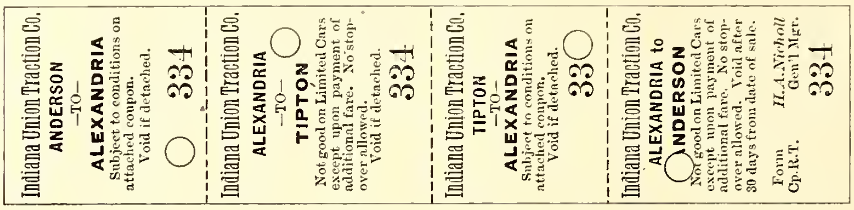


ROUND TRIP INTER-DIVISION TICKET, OVER FOUR DIVISIONS whole is very simple. With the idea of making the reading of the ticket easier, the printing is carried lengthwise of the ticket rather than across it as is the usual custom. This also permitted of a shorter ticket, as each coupon can be made narrower.

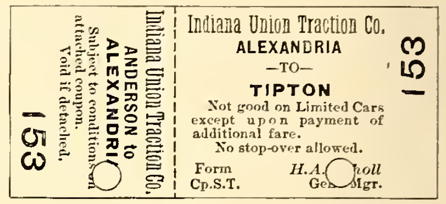
Eight different forms of these inter-division tickets are used, the separate forms bearing distinguishing letters and numbers by which they are identified. On the ticket reproduced, these are R. D. 4. The letter R. signifies a round-trip ticket, while D. 4 indicates that it is good over four divisions. Other forms of round-trip tickets have two, three and five going-trip coupons attached, being good over two, three or five divisions of the road.

Single-trip inter-division tickets, known as forms S. D. 2, S. D. 3, S. D. 4 and S. D. 5, are also used. They consist of the ticket proper, the agent's stub and a proper number of coupons, the reading upon which is similar in most respects to that on the "going-trip" coupons of the round-trip tickets.

When the travel between two towns on different divisions of the road is extensive, a card form of inter-division ticket is supplied, having the selling and destination points already printed in. Such tickets are used between Anderson and Tipton, via Alexandria, and in this and other instances they eliminate a great deal of work on the part of the selling agent in filling in the regular form of inter-division tickets. Round-trip as well as one-way tickets of this form are employed.

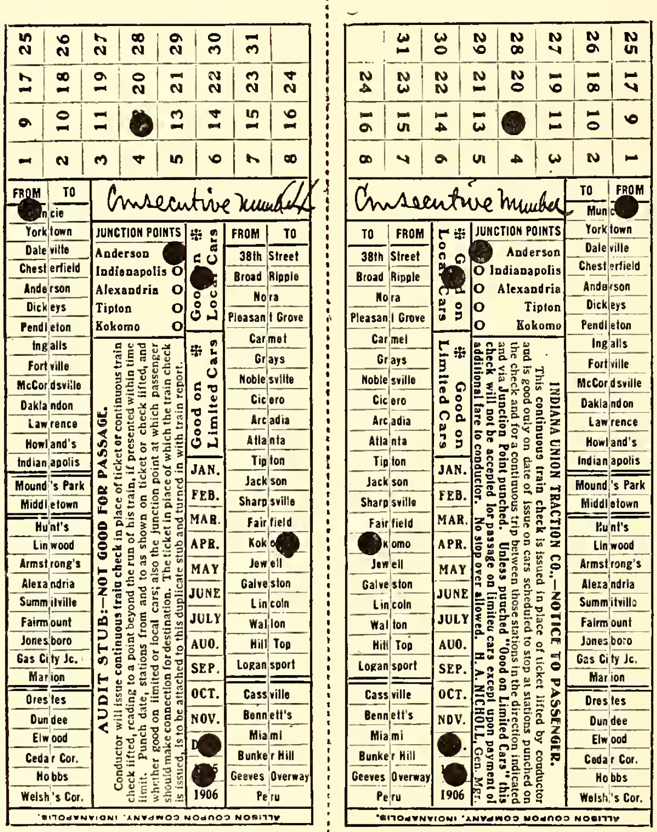

Indiana Union Traction Co.
ANDERSON —TO— ALEXANDRIA
Subject to conditions on attached coupon. Void if detached.
334
Indiana Union Traction Co.
ALEXANDRIA —TO— TIPTON
Not good on Limited Cars except upon payment of additional fare. No stop-over allowed. Void if detached.
334
Indiana Union Traction Co.
TIPTON —TO— ALEXANDRIA
Subject to conditions on attached coupon. Void if detached.
334
Indiana Union Traction Co.
ALEXANDRIA to ANDERSON
Not good on Limited Cars except upon payment of additional fare. No stop-over allowed. Void after 30 days from date of sale.
Form Cp.R.T. H. A. Nicholl Gen'l Mgr.
334

ROUND TRIP CARD FORM OF INTER-DIVISION TICKET, CIRCLES INDICATE PUNCH MARKS


Indiana Union Traction Co.
ANDERSON to ALEXANDRIA
Subject to conditions on attached coupon. Void if detached.
153
Indiana Union Traction Co.
ALEXANDRIA —TO— TIPTON
Not good on Limited Cars except upon payment of additional fare. No stop-over allowed.
Form Cp.S.T. H. A. Nicholl Gen. Mgr.
153

SINGLE TRIP CARD FORM OF INTER-DIVISION TICKET

The use of interline tickets was responsible for the development of the train check, of which a reproduction is shown. The check is now used on the interurban lines of the Indiana Union Traction Company, and permits of an interline ticket having but one coupon for travel on this system. The "notice to passenger" printed on the check explains its purpose. Assume that a passenger has purchased an interline ticket to Kokomo from one of the interurban lines leading into Muncie. When he boards the Indianapolis-Muncie division of the Indiana Union Traction Company at Muncie, the conductor collects the interline ticket and gives the passenger a train check punched, as shown in the reproduction. The conductor, however, retains the audit stub, which is evidence that he has carried a passenger from Muncie to Anderson, the junction point Anderson being punched. When the passenger transfers to the Anderson-Marion division of the road at Anderson, he gives up the train check first issued and receives a similar one punched from Muncie to Kokomo, but with the junction point Alexandria punched. On the next division he receives one with the junction point Tipton indicated. The conductor on the final division collects the train check issued on the next preceding division.


Consecutive number
FROM TO
Muncie, Yorktown, Daleville, Chesterfield, Anderson, Dickeys, Pendleton, Ingalls, Fortville, McCordsville, Oaklandon, Lawrence, Howland's, Indianapolis, Mound's Park, Middletown, Hunt's, Linwood, Armstrong's, Alexandria, Summitville, Fairmount, Jonesboro, Gas City Jc., Marion, Orestes, Dundee, Elwood, Cedar Cor., Hobbs, Welsh's Cor.
JUNCTION POINTS: Anderson, Indianapolis, Alexandria, Tipton, Kokomo
Good on Local Cars
Good on Limited Cars
38th Street, Broad Ripple, Nora, Pleasant Grove, Carmel, Grays, Noblesville, Cicero, Arcadia, Atlanta, Tipton, Jackson, Sharpsville, Fairfield, Kokomo, Jewell, Galveston, Lincoln, Walton, Hill Top, Logansport, Cassville, Bennett's, Miami, Bunker Hill, Geeves Overway, Peru
JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEP. OCT. NOV. DEC. 1906
AUDIT STUB:—NOT GOOD FOR PASSAGE.
Conductor will issue continuous train check in place of ticket or continuous train check lifted, reading to a point beyond the run of his train, if presented within time limit. Punch date, stations from and to as shown on ticket or check lifted, and whether good on limited or local cars; also the junction point at which passenger should make connection for destination. The ticket in place of which the train check is issued, is to be attached to this duplicate stub and turned in with train report.
INDIANA UNION TRACTION CO.—NOTICE TO PASSENGER.
This continuous train check is issued in place of ticket lifted by conductor and is good only on date of issue on cars scheduled to stop at stations punched on the check and for a continuous trip between those stations in the direction indicated and via Junction Point punched. Unless punched "Good on Limited Cars" this check will not be accepted for passage on limited cars except upon payment of additional fare to conductor. No stop over allowed. H. A. NICHOLL, Gen. Mgr.
ALLISON COUPON COMPANY, INDIANAPOLIS.

TRAIN CHECK USED BY THE INDIANA UNION TRACTION CO.

By this means each conductor retains evidence of having carried a passenger between two indicated points of his division. The space for the consecutive number is filled in by the conductor with the next number above that shown on the check he is collecting.

In addition to its use in connection with interline tickets, the train check is employed to return a passenger if he should get on the wrong train. It is also used when an agent has failed to provide a sufficient number of coupons on an inter-division ticket.

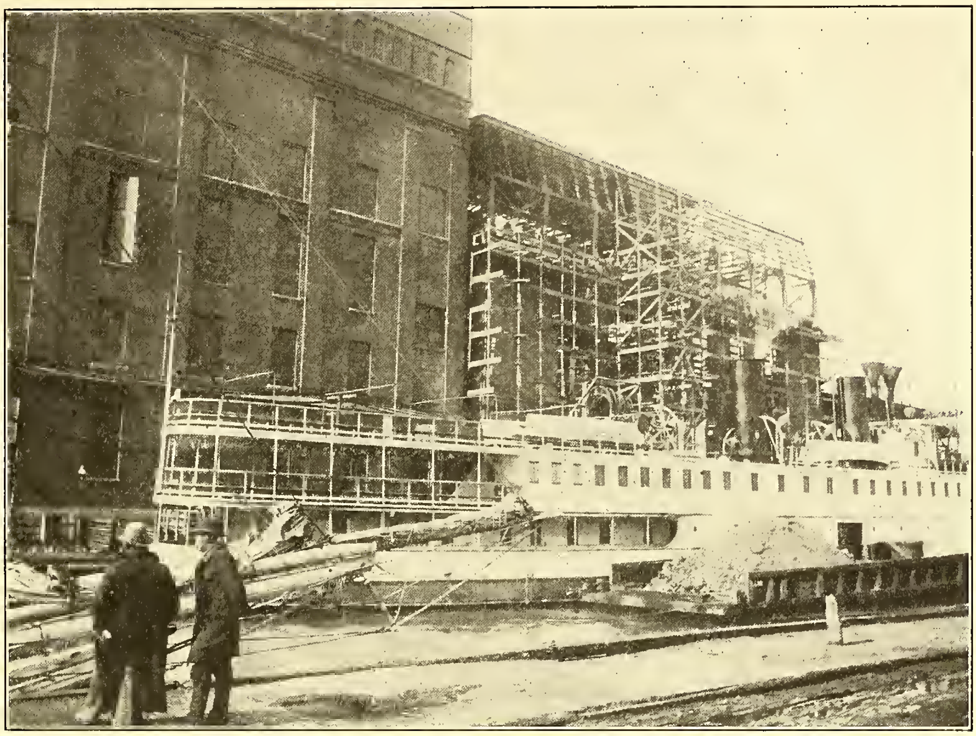
CHECKING DAMAGE BY LIGHTNING

H. H. Adams, superintendent of shops of the United Railway & Electric Company, of Baltimore, has an efficient method of determining the points on the system that are especially vulnerable to lightning. In his office he keeps a large scale map of the system, and whenever a car crew reports that a car has been damaged by lightning, he sticks a pin in the map at the point where the car was at the time. It is surprising how quickly a record of this kind will show up the locations that seem to be especially susceptible to lightning discharges. In the course of the season a few points will have a miniature forest of pins grouped around them, while long streches of track will show no pins at all. When a particular location begins to accumulate a collection of these tell-tale pins, a lightning arrester can be installed at this point and the trouble at once eliminated or at least materially reduced. From graphic records kept in this way over a period of years, it has been determined that the most vulnerable points are at junctions of lines and at sharp bends and curves.

NOVEL METHOD OF SECURING STEAM FOR OVERLOADED POWER STATION AT BALTIMORE

Owing partly to the crippling of its main generating station on Pratt Street during the disastrous conflagration which swept the city of Baltimore two years ago, and partly to the healthy growth of its business, the United Railways & Electric Company, of Baltimore, was forced to face the approach of the present winter with the prospect of an insufficient steam generating capacity at its Pratt Street Station. The work of increasing the boiler capacity at this plant was well under way, but it was found that the additional boiler plant could not be made ready in time to help out on the heavy traffic expected at Christmas time.

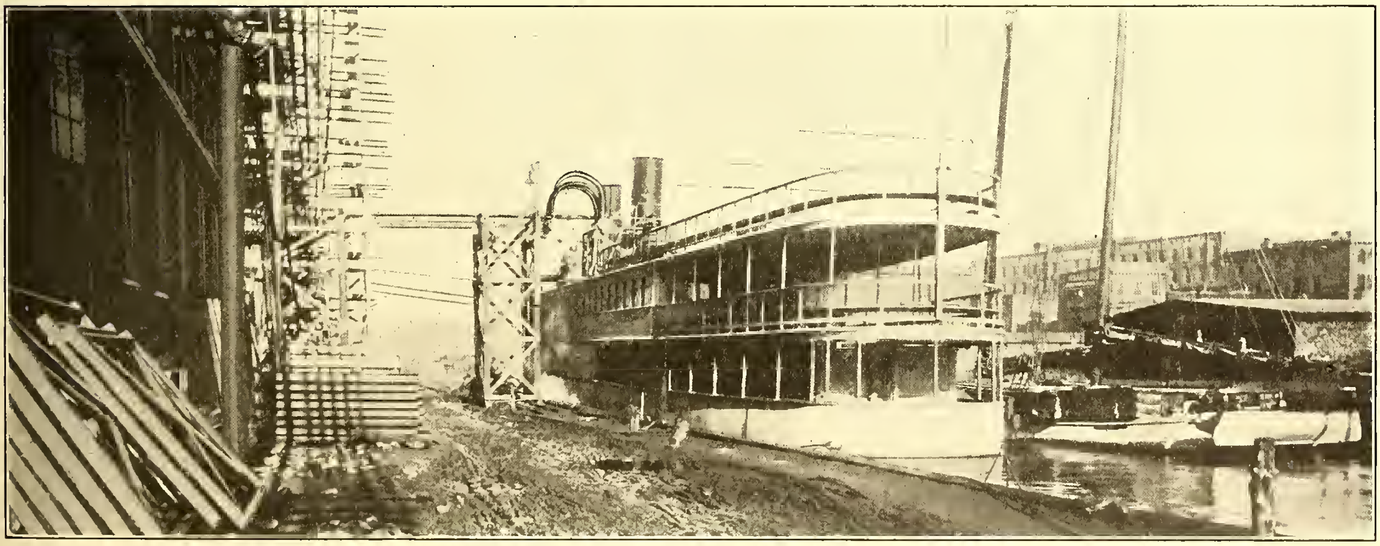
While casting about for a solution to the dilemma, the company's engineers hit upon the scheme of augmenting the boiler capacity at this station with steam taken from the boilers of a steamboat. Accordingly, the company chartered the "Lord Baltimore," a large passenger steamer, engaged during the summer in the regular service between Baltimore and Philadelphia, but which was out of commission at the time and laid up for the winter. The steamer was brought alongside the dock adjacent to the power house, and by means of an ingenious arrangement, connections were made so that steam generated in the boilers on the steamboat could be utilized for operating the engines in the railway power station.



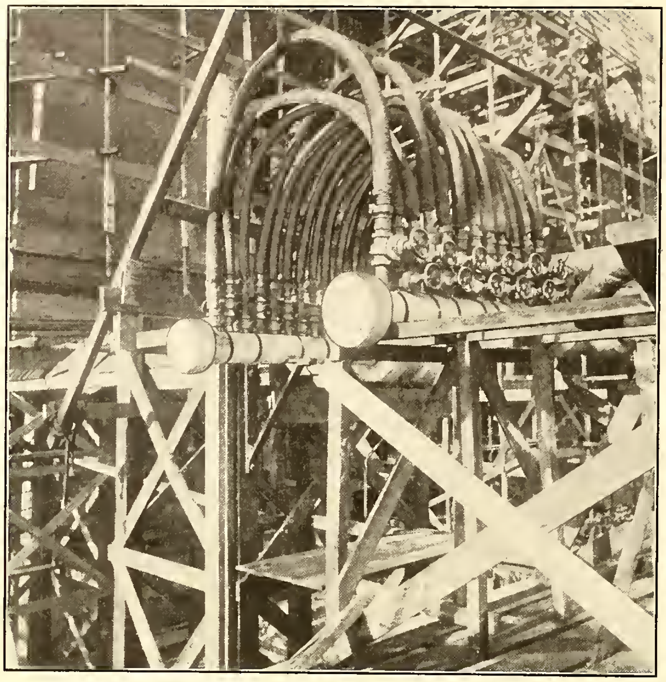
STEAMBOAT "LORD BALTIMORE" SUPPLYING STEAM TO PRATT STREET POWER HOUSE OF UNITED RAILWAYS & ELECTRIC COMPANY, OF BALTIMORE

The boiler equipment on the steamer consists of four Almy water-tube boilers, rated at 250-hp each, giving a total of 1000-hp in boiler capacity. The steamer's boilers have at times been worked at 50 per cent overload, so that on heavy peaks there was rendered available from 1200 bhp 1500 bhp as an auxiliary to the boiler plant in the station. No changes were made in the steam equipment on the steamboat, other than to disconnect the boilers from the engines. The "Lord Baltimore" is one of the largest and fastest steamers on the Baltimore service, and her boilers were built to work at 200 lbs. pressure.

To utilize the steam from the boat, a 10-in. tap was taken off from the main 10-in. steam header in the boiler room of the power station, and this tap was extended to the water edge, where the steamer was moored. The end of the 10-in. tap is supported at the edge of the pier on trestle work, where it terminates in a 10-in. manifold. On the ship side, supported on the upper deck of the steamer, is a second manifold 8 ins. in diameter. These two steam manifolds are connected together by a series of flexible copper tubes to allow for the rise and fall of the steamer with the tides, the arrangement giving a maximum range of 7 ft. The 8-in. manifold on the ship is connected by a single 8-in. header to the main steam drums of the ship's boilers. In order to give proper control over the auxiliary steam supply from the boat, a 10-in. stop



METHOD OF CONNECTING BOILERS OF STEAMBOAT TO BOILERS IN PRATT STREET POWER HOUSE valve was placed in the long tap connection just inside the station boiler room, and to avoid any possibility of bleeding the station boilers in the event that the steam pressure in the ship's boilers should drop below 200 lbs., a non-return auto-



DETAILS OF FLEXIBLE COPPER TUBES CONNECTING STEAM BOAT WITH LAND PIPES TO ALLOW FOR RISE AND FALL OF TIDES

matic valve was placed in the tap connection near its outer end at the water edge.

The arrangement described in the foregoing was designed primarily to help out as an emergency measure during the Christmas travel, but it proved so satisfactory that it has been continued ever since, and is now utilized for several hours every day during the peak loads.

SURFACE TRAILER OPERATION IN BOSTON

For somewhat over a year the Boston Elevated Railway Company has been operating trailers as an experimental measure between Oak Square, Brighton, and Park Street subway station, via Coolidge's Corner, Brookline Village and Huntington Avenue. This radical departure from the company's usual method of operating single cars upon its surface routes was inaugurated with the idea of determining by actual experience the suitability of trailers in meeting variable conditions of traffic, the relative cost of operation, popularity with the public, ability to maintain schedule time and such additional points of interest as might from time to time develop in the application of two-car trains to the problem of surface transportation as presented in a single route lending itself more or less favorably to analysis. Although the operation of these trailers has not been carried far enough to establish broad conclusions as to their desirability for the company's surface work in general, a number of points worth discussing have been evaluated.

The equipment of each train consists of a motor car of 26½-ft. body and a trailer car of 25-ft. body, both of the standard closed vestibuled type of the Boston Elevated Railway Company, shown on page 349. The forward, or motor car, is equipped with four General Electric "70" motors, single trolley, double trucks and the new air-brake equipment, "schedule AMS" of the Westinghouse Air Brake Company. The trailer car is also of the double-truck type, and it is equipped for air-brake operation through a single hose coupling connecting it with the motor car. Current for the lights and heaters is supplied to the trailer through a jumper cable from the motor car.

The air-brake equipment of these trains represents a notable advance over ordinary "straight-air" apparatus. Previous practice in the braking of motor-trailer trains in street railway service has almost entirely followed the plan of equipping the motor car only with braking apparatus. The new schedule "AMS" was described briefly in the Street Railway Journal of Dec. 9, 1905, in connection with W. S. Bartholomew's recent New England Street Railway Club paper. It provides an equipment for both motor and trailer cars, and eliminates the necessity of having a straight-air brake, pure and simple, for the handling of the motor car singly, the added features being a straight-air release of the brakes from the brake cylinder of the head car and provision to enable applications to follow each other immediately without danger of depleting the auxiliary reservoir pressure. The triple valve of this equipment is of the plainest type, without a graduating value, but this triple is arranged with a quick recharge feature through a check valve of such capacity that the recharging of the auxiliary reservoir occurs in exact proportion to the release of the pressure from the brake cylinder and the recharge of the train pipe, so that one application can follow another as quickly as is desired. The graduations of the release are accomplished by piping the exhaust of the triple valve up to the brake valve, in the release position of which are in reality two positions—motor release and trailer release. The first movement of the brake handle in releasing permits the pressure to escape from the trailer car brake cylinder, while the pressure is held in the brake cylinder of the motor car, if so desired. The graduations are then made by the use of the straight-air release feature of the brake valve, out of the motor-car cylinder. The slack is taken care of by arranging a slightly higher braking effort on the motor car. The applications are made automatically and practically simultaneously on each car, and the results are that the trains are handled with great smoothness.

The bell signals between cars are given by electric buzzers located in the four vestibules. The forward car is manned by a motorman and conductor, the rear car having a conductor only. The conductor of the forward car is not allowed to give the starting signal to the motorman until he receives the signal from the rear car that all is ready for the car to proceed. The rear vestibule of the second car is equipped with an oil tail light, in harmony with the company's rule that all trailer cars on the system shall be so provided. In ordinary operation, the front vestibule door of the trailer car is kept closed, except at subway stations in the afternoon rush hours.

The distance from Oak Square, Brighton, to Park Street subway station, via Brookline Village, is 7.45 miles. These trains have also been operated over the route from Oak Square to Park Street, via Commonwealth Avenue, but only for a short period some months ago. In view of the fact that the Boston Elevated system is essentially of the radiating type, it is difficult to compare the performance of different classes of cars, since it is impossible to operate a single type of car over the entire length of a representative route. As the cars under special observation enter the congested district, they find themselves operating on the same tracks with numerous other cars which have been run upon the line from branch tracks, and it is extremely difficult to obtain any definite idea as to the relative popularity and effectiveness of any special type in such mixed service. For this reason the management of the Boston Elevated feels that further experience with the trailers is desirable, possibly on other routes, or with a car whose doors can be kept closed except during the time of stops.

Thus far the use of trailers on the Oak Square line appears to have no different effect upon the accident account than as though the cars were run separately. The improved braking equipment represents a certain factor of safety, and the operation of two cars as a single train unit at a longer time interval than would be the usual practice in making the same total mileage with two separate cars is also an element of increased safety upon the thoroughfares traversed. The Oak Square trains are run upon a 20-minute interval, and there seems to be no reason to anticipate any marked difference in the accident record than with single cars. If a type of car were used with doors closed while the car is in motion, it is probable that accidents to passengers would be very largely eliminated, in so far as they depended upon movements during exit and entrance.

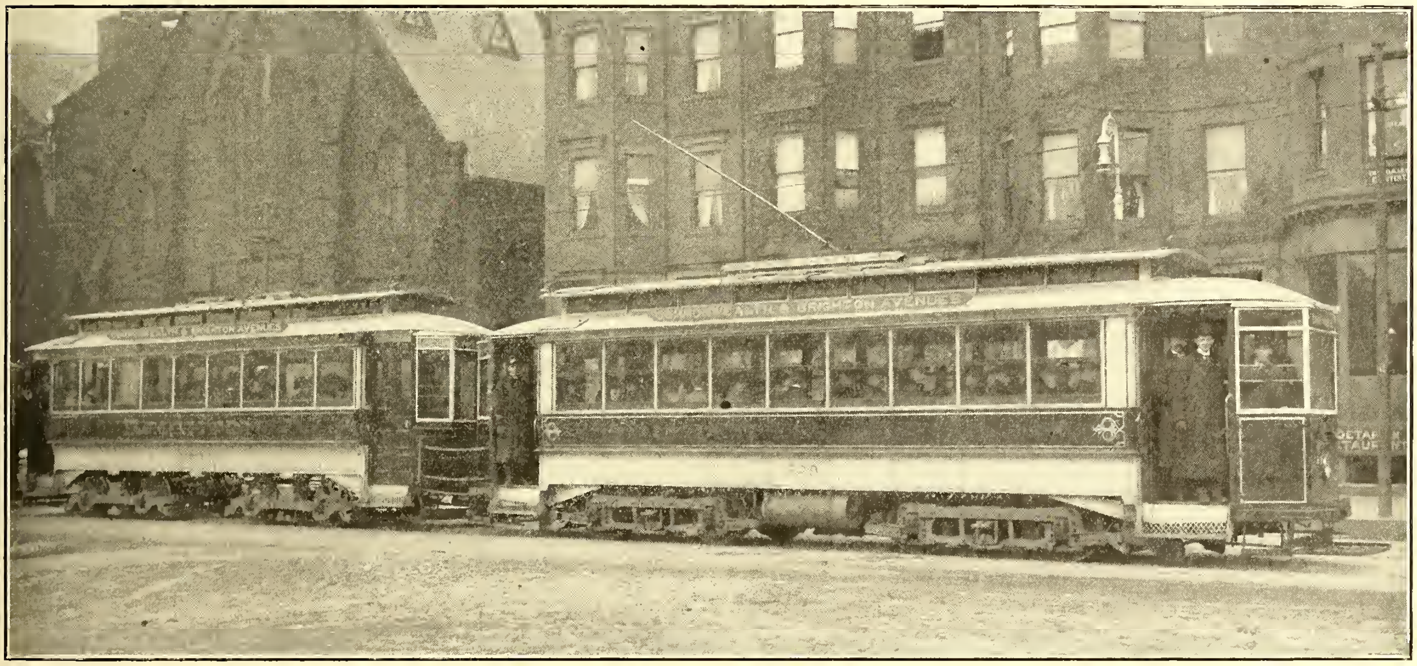
In regard to the popularity of the trains, the company has been asked to restore them upon one of the routes where they were tried during the rush hours with much success. The number of passengers per car-mile has been found to be less with the trains than with single cars, which means that fewer passengers have been obliged to stand in the trains. On the Oak Square line the trains are operated throughout the entire day, but their special usefulness appears in times of heavy traffic. On the line where they were operated during rush hours only, the interval was about 7.5 minutes. An impression prevails in some quarters that the length of stops is greater with the trailer outfit, but careful tests have shown this to be erroneous. Records kept of preceding and succeeding cars on a common route showed practically no difference in the maintenance of schedule time between the single cars with two-motor equipments and the motor-trailer trains. As the total motive power is the same per car in each case, the speed characteristics do not vary perceptibly. The trailer equipment rides comfortably, and there is very little shock in coming to a stop. The cars are coupled together by a draw-bar and by two sets of three coiled springs, one set on each side of the vestibules. On account of the numerous sharp curves upon the Boston system it would not be practicable to operate upon it a train of surface cars actually vestibuled in the center like a steam railroad train.

In October, 1905, a series of tests were made by the company to compare the power consumption of a four-motor car with trailer, a four-motor car, and a two-motor car in operation upon the Oak Square-Park Street route, via Brookline Village. These tests extended through a period of about twelve days, about thirty runs being averaged for each type of rolling stock. A summary of the results is tabulated herewith:

	Av. Temp.	Motors	Stops per Mile	Av. No. of Passengers	Av. Speed M. P. H.	Av. Kw.	Av. Watt Hrs. per Ton Mile	Watt Hrs. per Car Mile.	Weight, Tons
4 Motor car and trailer	63.9	4 GE-70	5.	M 33.3 T 30.5	9.8	37.6	124	3,829	30.8
4 Motor car	62.1	4 GE-70	4.7	67.7	10 3	30.4	145	2,885	19.9
2 Motor car	62.1	2 GE-70	5.5	61.7	9.5	19.1	121	2,029	16.9

The runs with the two-motor car were made between Allston and Park Street, via Brookline Village, a distance of 5.57 miles upon the regular route between Oak Square, Brookline and Park Street.

This journal is indebted to C. S. Sergeant, vice-president of the Boston Elevated Railway Company, for the particulars given herewith.



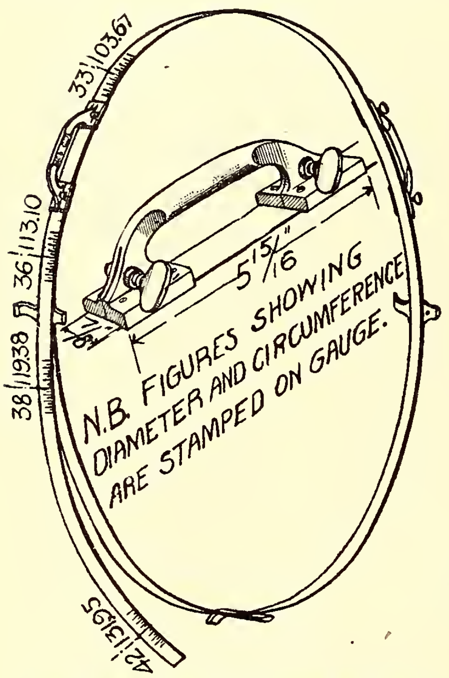
COMBINATION OF MOTOR CAR AND TRAILER OPERATED IN BOSTON. THE TRAILER IS EQUIPPED FOR AIR-BRAKE OPERATION

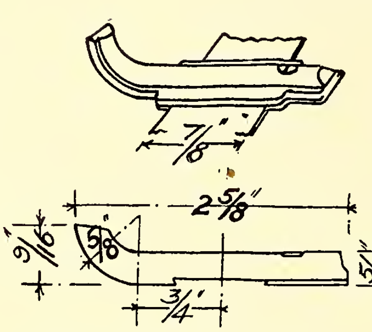
The Indianapolis "Morning Star" has adopted a novel and successful plan of stimulating advertising by the merchants of Indianapolis in that journal. The paper has inaugurated a plan of free excursions to the city over the interurban lines. The managers sent out 2650 tickets, good for transportation to the city and also good for the return trip when stamped by three Indianapolis stores advertising in the "Star," of whom purchases had been made. The first excursion was made Thursday, Feb. 8, and every ticket is said to have been used. One store stamped over 1000 tickets, and all the merchants report a big trade, and it is estimated that the excursionists expended $25,000 while in the city.

SOME CAUSES OF EXCESSIVE WHEEL WEAR

BY FRANKLIN M. NICHOLL

It would be safe to assume that 75 per cent of our electric railway companies are troubled more or less with excessive and irregular flange and tread wear of their wheels. In the majority of cases this trouble occurs in its worst form where the cars are operated in one direction and from one controller—that is, single-ended. The shape assumed by the tread and flange is usually indicative of the cause of the irregular wear. Generally the wear of the lead wheels in a truck on a single-end car is more rapid than that of the follower wheels, and this indicates an improperly designed truck. On the other hand, the production of sharp flanges on wheels in diagonally opposite corners of the truck, and of square flanges of the mate wheels, tends to show that there is excessive play at the journals. In a similar manner, by reasoning from effect to cause, other faults may be discovered.





CIRCUMFERENCE MEASURE. DETAIL OF LUG.

FIG. 1.—CIRCUMFERENCE MEASURE FOR TAPING CAR WHEELS, AND DETAIL OF LUG

The most frequent cause of irregular wear is improper design of trucks. Faulty design allows the centrifugal forces to center at various points in the truck, thereby shifting the center of gravity horizontally, causing unequal strains on the wheel flanges when on both curves and tangents. When this condition exists in trucks of "single-ended" cars, it will, almost invariably, cause the lead wheels to wear quickly and show the irregular wear far in advance of trailer wheels.

Another common cause of excessive and irregular wheel wear is the presence of excessive longitudinal play at the journals. This allows the center line of the axle to get out of square with the track. Where too much longitudinal play exists at the journals or between the journal box and the pedestal, the wheel nearest the gear, on account of the action of the motor, has a tendency to go forward, while the mate wheel has the reverse tendency, and this aggravates the condition. In this case wheels in diagonally opposite positions in the truck will wear the flanges alike. One diagonally opposite set will be flat or square, and the other sharp or pointed. This is plainly due to the play at the journals or to a diamond-shaped truck frame.

The production of a sharp flange on one wheel, with a double flange on the mate wheel, is often caused by the improper mating of wheels as regards diameters. The slightest difference in circumferences of the wheels on the same axle will throw additional weight and wear on the smaller or slow wheel, and will crowd the flange and cause it to wear sharp, while the flange of the mate wheel is drawn away from contact with the rail and receives no wear. On this latter wheel a new or double flange of irregular shape is thus formed on the tread. In the mating of wheels, many electric railways do not recognize the importance of the use of the circumference measure, Fig. 1. The calipering of wheels, no matter how carefully done, does not serve the purpose. The distance to be spanned requires calipers of large dimensions, and if these are of serviceable weight, they must be of light material, and hence are too flexible for exactness. By the use of the circumference measure, as shown, wheels may be measured with the utmost exactness. Lugs, conforming in shape to the throat of the flange, are provided at frequent intervals on the tape, and these enable measurements to be taken closely and in like positions on the two wheels to be mated.

Other frequent causes of excessive wheel wear are uneven wear or extreme hardness of brake-shoes; large variation in the gage of the track in connection with worn or narrow rails; lack of and insufficient elevation of the track on curves; poor quality of the material in the wheel, and lack of uniformity of its texture. Sometimes the cause may be an unbalanced condition of the car body, which throws undue and constant pressure on all the wheels on one side of the car. This latter condition is a very serious and expensive one, and is especially the case with single-end cars. It can best be remedied by placing counteracting weights on one side of the car, thus righting the car body. Installing heavier springs in the trucks on the one side of the truck, as is sometimes done, does not equalize the weight, and therefore does not remove the excessive wear.

The proper clearance between side bearings, permitting the free radiation of the truck and its adjustment to the inequalities of track, is also essential to good wheel wear, though of greater importance from a point of safety. Steam railroads usually allow 1-16 in. on each side between the side bearings of passenger coaches, and ⅜ in. on freight cars. In each case due allowance is made for deflection of bolsters, and adjustment is provided for wear of center plates. These center plates are narrow under the bearing to aid the free radiation of the truck.

For the purpose of maintaining a more complete wheel record, and in order that the various causes of excessive wear, as above mentioned, may be determined and noted in the early life of a wheel, the following method will be found desirable.

Having adopted a certain standard of design or designs of tread and flange, a fac simile of the contour of the face of the wheel should accompany the record of each wheel. At regular intervals of not less than thirty days, impressions should be taken of the wearing surface of all wheels by means of plaster of paris casts. The sharp outline of the cast may then be drawn by means of a hard pencil on the record within the original fac simile, and the most minute detail of wear may then be observed. Comparisons may then be made with mileages, as shown opposite each outline. The plaster impressions may be taken very easily, and without the removal of wheels from the truck, or the truck from the car. The entire operation does not require more than 15 minutes, and with a number of molds one man should be able to complete one car an hour, or ten cars per day. The mold, Fig. 2, is constructed of pine or other white wood in the form of a box without a top. The bottom is cut away to allow placing on the wheel. The two sides and ends are hinged, and a hook is provided for opening and closing. The interior surface of the box is shellaced and rubbed down several times, and when taking an impression, the surface of the wheel is oiled to prevent the plaster from adhering and to obtain a well-defined outline. To

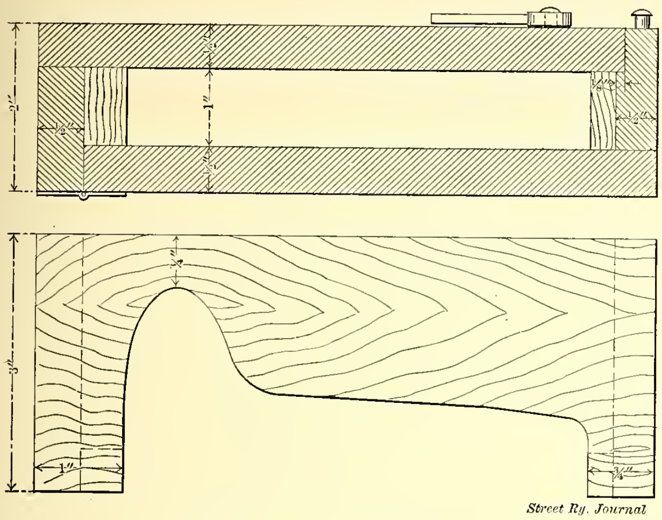


FIG. 2.—MOLDING FOR MAKING PLASTER CASTS OF WHEEL FACE

prevent the fluid plaster from running through the openings at the corners of the form, caused by the wear of the wheel, oil-soaked waste is used to surround the mold, and after the removal of the mold from the cast, a sharp knife is used to trim the impression to obtain the true contour.

This method of taking casts may also be advantageously used during tests to determine the different effects on the wheels of various types of brake-shoes. In steam railway practice, the method is employed extensively to obtain impressions of defective wheels under foreign cars which have caused, or are thought to have caused, an accident.

On interurban roads operating a small number of heavy "single-ended" cars with steel-tired wheels, and where facilities for turning and truing are not at hand, the cost of maintenance of wheels, due to the excessive flange and tread wear, amounts to a large proportion of the cost of maintenance of entire rolling stock, and thus decreases, to a large degree, the net profits from operation.

THE MONORAIL DISCUSSED BY BROOKLYN ENGINEERS

The Brooklyn Engineers' Club was entertained recently by F. B. Behr, the English engineer, who in an illustrated lecture explained the principles of the monorail system which he is advocating as a means to relieve some of the congestion on the local street railways. With stereopticon pictures Mr. Behr showed interiors of the cars which would be run on his road, sections of the experimental track in Germany, and drawings giving the mechanical construction of the cars. Most of the lecture which dealt with local conditions had to do with the line Mr. Behr proposes to run down Fourth Avenue, Brooklyn, to Coney Island, starting from the interborough terminus at Flatbush Avenue.

DETERMINATION OF FEEDER-DROP

BY J. E. WALLACE

In the "Electrical World and Engineer" for Nov. 5, 1904, the present writer was the author of a short article, under the title of "Economics of a 200-Mile Transmission," in which were given various formulæ for the determination of the most economic efficiency of transmission under various conditions. The article was the subject of kindly editorial comment, and later received considerable attention in the issue of the same paper for Dec. 31, 1904, the writer having used it as a basis for the discussion of a paper read by a prominent engineer before the American Institute of Electrical Engineers. Since no rebuttal has been made to the arguments offered by the writer on that occasion, it may be presumed that the mathematics underlying the investigation were correct. The same mathematics form the basis of the present writing.

In several instances the writer has found it the practice of superintendents and engineers to estimate the drop they will allow at a given point, and then use the following formula to determine the size of feeders:

$$\frac{11.1 \times \text{distance in feet} \times \text{amperes}}{\text{drop in feeder}} = \text{circular mils}$$

Independent of the drop in the track returns, the actual drop in the feeder cables, in accordance with Roebling standards, is:

$$\frac{10.16 \times \text{distance in feet} \times \text{amperes}}{\text{circular mils}}$$

The writer is not acquainted with the reason for the selection of the constant 11.1; whether it was from a test under actual practice and that the constant was intended to include an average track drop, or whether at an earlier period in the history of the art the wire mills were not able to produce as pure commercial copper as at present. In any event, the use of the higher constant increases the size of the feeder about 8.5 per cent to offset any track drop, irrespective of the distance from the power house, or the amount of current involved. While such methods of procedure may produce results that satisfy the operating department, they do not promise, unless handled with rare judgment, to lead to results best suited to creating dividends for the stockholders.

Under the conditions that usually exist in connection with railroad work, pole construction costs need not be included among the items involved in an economic consideration of a drop best suited to a given distance. The following formula, based on the delivery of the cheapest kilowatt, will determine a drop which takes due regard to the cost of power annually absorbed by the line as differentiated against the annual charges on the line investment, but omits considerations of the pole construction:

$$\text{Drop} = \frac{E}{2}\left[1 - \frac{QT + \frac{M}{E^2} - \sqrt{\frac{M}{E^2}\left(QT + \frac{M}{E^2}\right)}}{QT}\right]$$

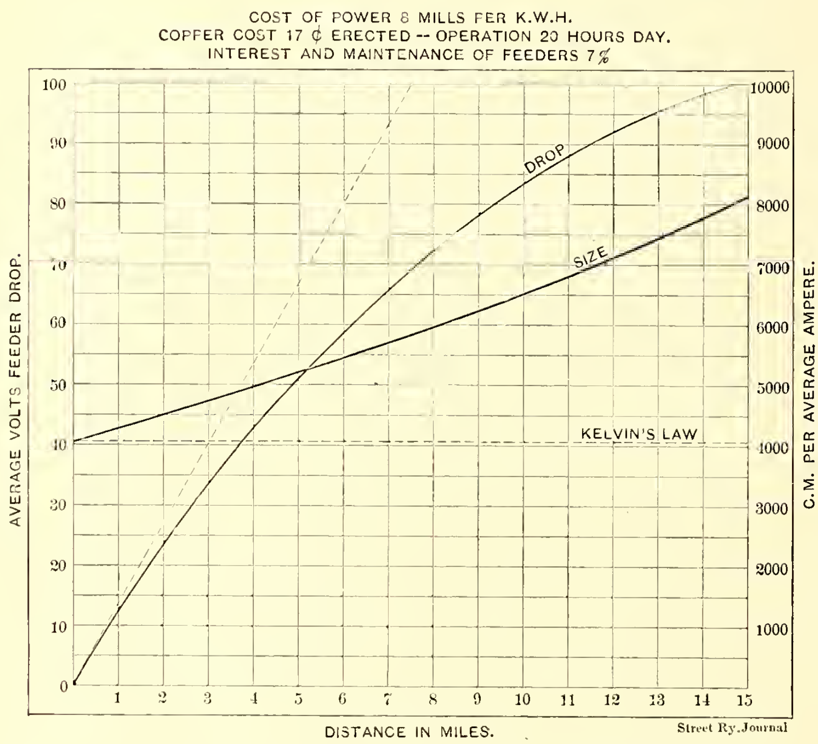
in which

E represents station voltage.
Q represents generating cost of power in terms of a kw-year.
T represents hours operation per day divided by 24.
M represents product of the various line constants, distances, specific weight and resistance of conductor, price, annual charges, etc.

The feeder drop having been established for any particular distance, it is a simple matter to calculate the size of feeder required, either by the use of the first-mentioned formula, with Roebling's constant, or other short methods.

The writer has found a curve chart of very great assistance in making such calculations, and herewith presents such a chart which he had occasion to make for the purpose of checking up a system using entirely overhead feeders. While it is based on the market price of copper being 15 cents, in other respects it is fairly representative of conditions that might now exist in many systems throughout the country, but each system should have a chart calculated in accordance with its own conditions. Since in the ordinary course of events copper is bought freely at prices below 15 cents, and somewhat sparingly when the price is above, a chart on a 15-cent basis is used for the purpose of this writing. In connection with these curves, a fact which may be very interesting to the readers is that the curves start from the power house end of the line in conformance with values as prescribed by Kelvin's law.

In checking up a system, the method pursued by the writer is to take observations at the power stations, or sub-stations, for the purpose of establishing the average current demands of each section of trackage, and then apportion the results over each mile of track pro rata to the tonnage of traffic over the track, unless some heavy grade occur in the section. In



CURVE CHART FOR CALCULATING FEEDER DROP

this event, it is best to ascertain if more than a pro rata share of current is required by the traffic. Having established the average current demands of each mile of track in the section involved, the next step is to consult the chart and learn how many circular mils should be added to the feeders on account of the current demands and distances from the power house of each individual mile of track. Totaling up the various items will give the number of circular mils of feeders which should leave the power house to feed the section under consideration. Should the section consist of a long line with one end near the power house, some judgment must be exercised in the matter of subdividing the feeder into standard sized cables, with the object of running each cable to a given point out on the line before connecting into the trolley circuit, or contact rail, as the case may be.

In some instances it is the practice of a management, where a group of feeders leaves the power house to feed a given section of track, to tie all cables together and to the trolley at frequent points along the line. Electrically, the result is the same as though one large cable were used from the power house to the nearest feeding point and then tapered off as the demands grew less. The writer does not consider such methods as being in the line of good practice. Cables should run independently from the bus-bar to various points on the line, and there only be tied into the general system. The result will be a trolley potential slightly lower at points near the power house, but out on the end of the line a much better potential will be found than would otherwise result.

To illustrate, a section of track, some 5 miles in length, called for 3,500,000 circ. mils of copper leaving the power house. This was best equipped by installing a 500,000-circ.-mil cable, frequently tied into the trolley and carried to nearly the end of the track, and three cables of 1,000,000 circ. mils each, run independently to proportionate points and there connected into the 500,000-circ.-mil cable.

The formula given above for an economic feeder drop is one-half that which should be found in an all-copper circuit, and on the basis of the same current density in the feeder, is the actual drop that would occur with zero resistance in the ground returns. It is, therefore, requisite that the tracks shall have a conductivity at least the equal to the feeders carrying the current that returns through a given piece of track. Properly bonded, many track systems will meet this condition, but it frequently occurs that at some point near the source of a current supply, there is a zone in which the conductivity of the feeders overbalances that of the tracks, in which event, aside from the consideration of electrolysis, it is economic to reinforce the conductivity of the tracks. In connection with ordinary American track steel, the writer uses 12 to 1 as the ratio of conductivity of copper to an equal cross-section of steel.

In cases where the switchboard is not available to take observations on current demands, the feeder determinations can be made by the method of watts per ton mile. Watts per ton mile will vary between the limits of 155 and 100; the former holds for urban service with light cars and frequent stops, the latter for interurban service with moderately heavy cars and comparatively infrequent stops. Low grades, with traffic in both directions, do not increase this average materially. With the ordinary car weighing from 15 to 18 tons and making about five or six stops to the mile, 140 will be a fair average.

If electric heaters are used, the current demands per car for periods of the year will be increased about 25 per cent in northern latitudes, the demands, of course, tapering up to a maximum and gradually falling off. After the energy in watts for a given section of trackage has been obtained, it is a simple matter to refer to the chart, and from it determine the amperes and, finally, the size of the feeders. An average track drop for a 70-lb. rail is 3.8 volts per mile per 100 amps., and this should be added to the drop given in the chart to determine the average voltage at the car when the amperes are calculated from the watt consumption.

Naturally, as the voltage decreases, the current demanded per ton mile increases. It is not absolutely correct, therefore, to take the average amperes shown at the power house and apportion them to each mile of track, as has been suggested above, but the chart offers a very convenient aid to those who desire to make the exact calculations involved in the fact that the ampere consumption per ton-mile increases as the car gets further from the power house.

The starting current of a car is approximately three times in excess of the average current, and where few cars are on a feeder, they may quite frequently all start together, causing the maximum drop in both feeder and tracks. This fact, taken in conjunction with satisfactory operation of cars at distant points, makes the economic adjustment of long feeders a troublesome problem, and to meet the situation it is at times considered best to resort to boosters rather than go into alternating current and sub-stations, or storage batteries, either of which are costly, as well as requiring separate attendance.

The writer has met engineers who assert, in connection with long feeders and a given average current flow, that if a certain drop were proper and economic without a booster, a much greater drop would be allowable with a booster. An analysis of the facts in the case will not substantiate the truth of such a statement. The reader is directed to consult the curve sheet shown in connection with the article by the writer, cited as published in the "Electrical World and Engineer," Nov. 5, 1904, and he will there see that for a given distance the economic relation existing between voltage and line efficiency calls for a higher line efficiency as the voltage increases. On consideration it will be apparent that if the station voltage is increased and the line drop and current held constant, the efficiency of the transmission is increased. Therefore, the booster seems to act in the direction of automatically adjusting itself to the economies involved. Kelvin's law, for a given average current flow in a feeder, would demand the same average line drop with or without a booster; but, as a matter of fact, if the boosting apparatus were machinery of 100 per cent efficiency and did not increase the cost of a kilowatt delivered to the line, the exact economics of the situation would call for a slightly greater average feeder drop with the increased voltage, but the inefficiency of the boosting apparatus will balance up any such matters, and the writer, for a given current average, recommends the same size feeder with or without a booster.

The safe use of boosters requires some thought in the matter of preventing or providing for cars bunching on that portion of the line fed by the booster, and if one end of a long line is fed direct from the power house and the other end boosted, the boosted feeder will, of course, take a greater proportion of the trackage than if no booster were used, hence the feeder should be calculated accordingly. For every-day work, boosters are not very much in favor with operating engineers of experience, except in connection with a very limited number of cars. They have their place, however, and doubtless will always be used to help out situations, particularly if the situation involves a compact urban system with one or two long lines reaching into districts which do not supply a heavy volume of traffic, or if the traffic is fairly regular the year around, with exception of a limited number of days, when, due to special conditions of fairs, races, picnics, etc., there is very heavy traffic. In any such cases, the average current, upon which is based the feeder drop, should include the current demands of the special traffic.

The storage battery, as a means of holding up the voltage on the end of long feeders, has features which make it very desirable as compared to boosters. The latter accentuates the pulls on the power-house machinery, caused by cars starting simultaneously, whereas the storage battery tends to give the power house an even average rather than a fluctuating load.

The West Jersey & Seashore Railroad, to be equipped with electricity between Camden and Atlantic City, N. J., will increase its capital to $10,000,000. The company is one of the subsidiary companies of the Pennsylvania Railroad Company.

STANDARDIZING TRUCKS

BY WARREN L. BOYER

In nearly every issue of the Street Railway Journal for the past few months reference has been made to standardizing electric railway equipment, and the tendency of every operator is to work to this end. Some of the largest systems in this country have men employed to do nothing but follow this part of work, their time being devoted to find the simplest and most economical equipment to meet their requirements. Where one company has absorbed another, a mixed equipment is practically inevitable, and the larger the number of roads brought under the one head the longer will this list of mixed equipment be. The result is that unless corrected the cost of maintenance will not be reduced by consolidation, except in labor, and if the cars of one line are operated over lines previously foreign, an extra line of supplies must be provided to meet the requirements of the foreign car. If this is not done, the car must either be taken out of service until the supply parts are obtained from the home line or be run back as a "cripple," which may result in breaking the schedule, especially so if the car must be towed home. This condition is more serious to-day than it ever has been, for numerous suburban cars run over foreign lines 60 miles and 70 miles from their own base of supplies, which means two to four hours run even when the car is in good condition. Any depot master or foreman appreciates what it means to carry supplies for a mixed equipment, for there are numerous cases where he is "just out" of that special trolley pole, or maybe that size or style of brass, even though he has quite a large supply of another kind, which will not do, so the car must be tied up until proper parts are received from headquarters.

A great many operators find fault with manufacturers and supply agencies for delays in filling orders for supplies, which are really unavoidable in some cases, for if one stops to consider what an enormous stock these houses would have to carry to meet each and every demand, he would not be quite so impatient. The condition of the iron market to-day is such that even standard sizes cannot be delivered under from three to six months, so the result is apparent. The standardizing of parts for railways would not only cut down the cost for them, but would also enable the manufacturer to carry a larger supply of those parts needed for repairs, so he could fill orders promptly. It is very easy indeed to say nothing can be done in standardizing, but it can be if given the proper support. The results probably would not be apparent for several years, but would gradually make themselves felt.

Let us consider trucks. Why cannot all trucks of a class be constructed to the same dimensions in regard to the following points?

(1) Distance from center to center of side frames.

(2) Length of wheel base.

(3) Height from rail to swivel plate.

(4) Height from side bearings to swivel plate.

(5) Distance from center to center of side bearings.

(6) Width of car body swivel plate, size and spacing of holes and same size and shape of ring or boss to engage truck plate.

Each of these topics will be considered:

DISTANCE FROM CENTER TO CENTER OF SIDE FRAMES

At first thought, one who does not go into details naturally thinks this is not an important point. But the distance from center to center of side frames governs absolutely the length of axle, for the latter must be central with the journal bearings so that the entire load is properly supported, and there is no good reason, except that of gage, for this distance to vary. The present variations came from the practice of different truck builders in making their centers of frames to suit different trucks. Some even went so far as to change centers of frames with a change of wheel tread, so that a truck originally built for a 2-in. tread wheel would not allow the use of a wheel over that width tread without cutting away some of the side frame to permit the change. If it should not seem desirable to adopt one standard truck for certain reasons, there is no reason why all short wheel base trucks cannot be constructed of one width and with standard journals, and another standard for a long wheel base with M. C. B. journals. The frames should be made wide enough for the widest tread wheels generally used in the class of service to which the truck is adapted. The change in these centers will not affect the riding qualities or strength of the truck.

WHEEL BASE

Wheel base is a very important question in truck construction as well as in operation. Opinion at the present time appears to be in favor of a wheel base longer than the track gage, and up to a certain limit this is certainly desirable. A crude illustration in favor of a longer wheel base is a desk drawer. A wide drawer that does not extend into the desk very far will not pull out easily unless drawn from its exact center or from each side at the same time, but a drawer that extends further into the desk can be drawn out easily, as the binding cross-corners are practically eliminated. This same principle holds good in long wheel bases as regards the strain on the flanges. In addition the longer wheel base permits the use of a better bolster construction, such as providing wearing pieces, to take up the lost motion of the bolster between transoms. These eliminate the disagreeable jerking motion received when the brakes are applied. It allows more room for a suitable inside brake rigging. Trucks for outside-hung motors vary in wheel base from 4 ft. to 4 ft. 10 ins., and for inside-hung motors from 6 ft. to 7 ft. 4 ins. In most cases the dimension adopted is determined by the size of the motor and the construction of the bolster. A 6-ft. wheel base is rarely used, for with any substantial bolster and transom a small motor only can be employed, and clearances even then are very small. The writer thinks a 4-ft. 10-in. wheel base for outside-hung motors and a 6-ft. 10-in. or even a 7-ft. wheel base for inside-hung motors would be the most practical to adopt as standards. This would enable all truck builders to follow their own construction and still have room for the largest motors used to-day. A difference of 2 ins. or 3 ins. in wheel base would not affect the car builders in the least, and really would be a great advantage to them, for they could come to a standard location for platform knees, etc.

HEIGHT FROM RAIL TO SWIVEL PLATE

Height from rail to swivel plate is another point of importance, and proper car construction is often prevented if a low limit is set for the height of the car body from the rail. This height can, without doubt, be standardized for trucks of a class where the same diameter wheels and size of journal are used, and could be based on the same principles and requirements as in the matter of truck centers.

HEIGHT FROM CENTER BEARINGS TO SWIVEL PLATE AND DISTANCE FROM CENTER TO CENTER OF SIDE BEARINGS

These two subjects can be considered together, and while two separate dimensions are required, they must be in harmony. If this is done, any car body bolster would fit any truck adapted to that class, and would save considerable changing, both for the builder and operator. Master mechanics will appreciate this point more than anyone. The trucks govern these dimensions entirely, and they do not change with a change in the width of the car body.

SWIVEL PLATE AND RING TO ENGAGE TRUCK PLATE

This is another point of importance, for any make of trucks of the same class ought to fit. At the present time the car body bolsters are not of a standard width for the same weight of car, and vary from 6 ins. to 12 ins. This, of course, changes the spacing of the holes and the width of the plate between lugs. This is a point that could be standardized very easily and would save considerable annoyance.

THE INTERURBAN ROADBED

BY R. H. BALDWIN

The choosing of the proper grades for interurban lines is a more difficult matter than at first thought appears. In general, the engineer is prone to follow the old maxim of making cuts and fills balance. But this is an erroneous basis. The different bases in excavation and embankment give greater cross section for cuts than for fills, and this fact totally demolishes any possible chance of even approximate balancing. What may appear as a well-balanced profile will give quite different results in cross sections. Behan, in "Railway Location," says, and truly, "that the engineer should be able to show a more scientific reason in laying a grade line than the balancing of cuts and fills." One condition which often makes it difficult to secure a good roadbed is that the interurban engineer is sometimes restricted to a narrow right of way simply because some road over in the next county, located on a prairie, has but a 33-ft. right of way. The projected road, even with 2 per cent grade, may be obliged to have 20-ft. cuts and 15-ft. fills, but he is expected to work to as narrow a right of way as on a prairie. This was brought home to the writer in making a 65-mile location in Northern Wisconcin last spring. The promoters (?) had gone ahead and secured options on a strip 2 rods wide along the right of way of the steam line which they proposed to put out of business. The road was not built and never will be. The grading would have been about 12,000 yds. to 18,000 yds. per mile, as nearly as can be remembered.

This brings up another error of frequent occurrence. The early electric lines were built on 12-ft. banks without ballast. Some engineers still follow the old specification of an 18-ft. base in cuts for interurban lines. This leaves little or no room for ditching unless the cuts are widened out as borrow pits. If they are not widened, and the overhead line is bracket work, the pole gang will find that the function of the ditch as a water course is soon ended after they have planted their poles in it. Cutting outlets back of the poles does not help matters. The impeded drainage settles down around the pole, softens the ground, loosens up the pole, and the whole alignment looks like a country fence before the end of the season. Let us have 20-ft. base cuts, with ample ditches.

CONVERTING THE LINES AT MONTEREY

J. H. Wallace, manager of the Monterey Railway, Light & Power Company, of Monterey, Mex., states that the Expresa Mexicana, Slayden and Oriente y Sur properties have been purchased and are now operated under a syndicate of Canadian capitalists, and that the entire system is to be converted into an electric railway. The company's officers have not yet been named. This syndicate controls the water works, sewer system, light and power and electric railway franchise, all of which it is contemplated having in operation by February, 1907, if not sooner. A new electric line is also being constructed from the city of Topo Chico Hot Springs.

CONVENIENT FORM OF ACCIDENT REPORT

C. A. Avant, claim attorney for the Birmingham Railway Light & Power Company, of Birmingham, Ala., has devised an accident report blank upon which conductors and motormen make their reports of all accidents that occur. This form has been designed with the idea of reducing in so far as possible the amount of writing necessary to give a comprehensive account of the details connected with the occurrence. It will be noticed from the sample blank reproduced in Fig. 1 that the form contains a number of questions, many of which the employees can answer by merely putting a cross mark in the proper space. It is believed that this practice of giving the conductor and motorman a definite set of questions to answer, covering the essential points of the case, has resulted in more satisfactory reports than when the em-

No. M-6000 Birmingham Railway, Light & Power Co. (Date) Jan. 27, 1906
Form O 1—2046

PERSON FALLING—ACCIDENT REPORT

Nature of accident.—Person falling,—Ejectment.
Person fell from car.
Name of injured person—If unknown—man, woman, boy or girl.
Mariah Jenkins
ADDRESS: Smithfield Ala.
Place of ACCIDENT: 2nd Ave. between 20th & 21st Sts
LINE: Gate City CAR No. 329 NORTH SOUTH EAST WEST X

COLOR?	White. Black X	TIME?	9:20 A M.
About HOW OLD?	About 38 Years.	Daylight?	Yes. X No. Twilight.
Was person ALONE?	Yes. X Woman. Man. Child.	CAR WAS	Standing Still. Starting. Slowing up. On 5 Points. X At full speed.
Did person have any BUNDLES?	Yes. X No. Don't know.		
Was person DRUNK?	Yes No. Drinking. Don't know. X		
Was person getting ON or OFF?	On. OFF. X	CAR WAS	On Time. X Minutes Late.
Front or rear PLATFORM?	Front. X Rear. Running Board	Did car stop at last station?	Yes. X No.

In what part of car was Conductor?	On rear platform
Where and in what position was injured person when you first saw him?	Jumping from car
Was any assistance given him, and by whom?	Carried to St. Vincents Hospital
What did he say?	Saw her friend on side walk and wanted to get off.
Did he walk away? Where was he carried?	Walked away. Got on car. Carried to hospital

INSTRUCTIONS.—Make Crossmark (X) BEHIND the answers which apply

SPECIAL STATEMENT OF CONDUCTOR.

How was your attention first called to accident? By seeing the woman and the basket falling.

Describe here what happened, what you saw, and what other passengers said. This woman saw a man on the street and when he waved his hand at her she picked up her basket of clothes and went out the front door and jumped off before the motorman could stop. She dropped her basket and got her clothes muddy. The passengers said she should have known better than to jump off of the car while it was moving, and that the man on the sidewalk was to blame for the trouble, that it was no fault of ours. She semed to be very frightened and excited

Describe how person appeared to be hurt.

Was clothing torn?

If dispute about transfer, get number of transfer.

(If you need more space, use other side.)

Accident reported verbally or by phone to Mr.

Dr. was called.

Conductor T. J. Kennedy Badge No. 654

WITNESSES

Name T. Hawkins Address Bessemer, Ala
Name J. T. Thompson Address Ensley, Ala.
Name Henry Barnard Address Pratt City, Ala.
Name J. R. Compton Address Woodlawn, Ala
Name E. D. Drummond Address West Highlands, City.
Name Y. L. Senn, Address East Lake, Ala

(If you need more space, use other side.)

SPECIAL STATEMENT OF MOTORMAN.

Describe here what happened, what you saw, and what other passengers said. The first I knew of the accident was when the man begun waving his hand about this time the woman with her basket of clothes run out and jumped off falling and dropping her basket. I stopped the car as soon as I could

How was your attention first called to accident?

Motorman R. H. Greer Badge No. 186

FIG. 1.—FORM USED AT BIRMINGHAM, ALA. FOR REPORTING ACCIDENTS. MUCH OF THE INFORMATION REQUIRED IS GIVEN BY MAKING CROSS MARKS AFTER CERTAIN CAREFULLY SELECTED QUESTIONS

No. Birmingham Railway, Light & Power Co. (Date) 190
C-2

WAGON, PERSON OR CAR STRUCK—ACCIDENT REPORT.

NATURE OF ACCIDENT
Name of Injured Person, Owner and Driver of vehicle. If unknown, was it man, woman, boy or girl.
ADDRESS:
Place of ACCIDENT:
LINE: CAR No. NORTH SOUTH EAST WEST

COLOR?	White Black	TIME?	M.
About HOW OLD?	About Years	Daylight?	Yes. No. Twilight.
Who was with PERSON?	Alone. Woman. Man. Child.	CAR WAS	Standing Still. Starting. Slowing up. On 5 Points. At full speed.
Was person DRUNK?	Yes. No. Drinking. Don't know.		
Kind of VEHICLE?			
TRACK WAS	Dry. Wet.	CAR WAS	On Time. Minutes Late.
IF STOCK Horse Mule Cow Hog	Size Color Quality	Did car stop at last street or station?	Yes. No.

About how far ahead of car was injured person when Motorman first saw him?	feet.
How far from track?	Right side. Left side.
In what direction was he going?	With car Toward car From right. From left
Did he notice car before it struck?	Yes. No.
If so, what did he do?	
Was he thrown?	
What did he say?	
Where did he go?	Walked away. Carried to
Distance in paces from point of Accident to front of car where stopped?	paces.

INSTRUCTIONS—Make Cross-mark (X) BEHIND the answers which apply

SPECIAL STATEMENT OF MOTORMAN.

Describe here what happened, what you saw, and what other witnesses said.

Describe how person was hurt, or how much vehicle was damaged.

(If you need more space, use other side.)

Accident reported verbally or by 'phone to Mr.

Dr. was called.

Motorman Badge No.

WITNESSES.

Name
Address
Name
Address
Name
Address
Name
Address
Name
Address
Name
Address

(If you need more space, use other side.)

SPECIAL STATEMENT OF CONDUCTOR.

Describe the vehicle and animals.

Describe injury to person or animals, and damage to vehicle.

Was there car passing in OPP. direction?

Conductor Badge No.

FIG. 2.—FORM USED AT BIRMINGHAM, ALA., FOR REPORTING FRONT-END ACCIDENTS

ployee is merely instructed to give a complete account of the occurrence in his own words. When the information desired is not indicated by concrete questions, many employees will give a rambling statement of an accident without covering the essential details, and the statements will be of little real value to the claim department in working up its cases. The set of questions as printed on the blank used at Birmingham serves to direct the employee's attention to the important points and aids him in giving a concise, condensed and correct statement of the occurrence in a few words.

It will be observed the questions asked are practically the ones the employee would be obliged to answer if put on the witness stand, and the form as prepared is virtually a legal examination of the conductor and motorman concerning their knowledge of the accident.

Some question might arise as to the validity of an answer

WAGON, PERSON OR CAR STRUCK.

SUPPLEMENTARY TO ACCIDENT REPORT No. ______

______ ______ 190__
(Name of Injured Person) (Place of Accident)

Weather ______ Condition of ground ______
(Wet, dry, muddy, ice, snow)

Grade at point of accident in direction of car ______

Grade for 200 feet approaching point of accident ______

Kind and condition of paving or landing place ______

Was injured person's view of car obstructed and by what ______

Was motorman's view of injured person obstructed and by what ______

Location and distance of nearest street lamp ______

Was it burning at time of accident ______

Report on condition of car. Information obtained from M. M. ______

______

______

______

Condition of brakes ______

Condition of headlight ______

Special report about condition of car. Describe injury to car or marks on it ______

______

______

______

______

FIG. 3.—FORM USED AT BIRMINGHAM, ALA., FOR MAKING SUPPLEMENTARY REPORTS OF ACCIDENTS

made by a cross mark after a given question, but the company's attorneys have advised that an answer made in this way is as binding in law as would be a written answer. This question has been well established, although as a matter of fact, the employee's reports are not intended to be used in court but are merely for the information of the claim department. However, the original reports can be produced as competent evidence, if the necessity arises.

In the routine work of the claim department three copies are made in typewriting from the original report; one copy going to the general manager, one to the general attorney and one to the claim attorney. As the forms permit of giving a great deal of information by placing cross marks in the proper spaces the routine work of copying reports has been greatly simplified. The same idea has been carried out in preparing other forms used in connection with the work of the claim department. Fig. 2 is the blank used by motormen and conductors in reporting accidents caused by the front end of the car, such as striking a wagon, person or another car. Fig. 3 is a blank used by inspectors in making reports supplementary to reports made by car men.

It is announced that W. R. Grace & Co., of New York, have obtained a contract for the construction of an electric railway at Lima, Peru. American electric apparatus and American railway material will be used entirely. The line will be over 30 miles, and is expected to be in operation within a year.

NOTES FROM NEW ORLEANS

Among other things with which the street railway visitor to New Orleans is forcibly impressed, there are two in connection with the system of the New Orleans Railway Light & Power Company, which stand out with particular prominence. In the first place, a casual inspection of the New Orleans soil will probably lead to wonderment as to how engineering operations, involving the building foundations for power stations, track work or permanent structures of any kind can be carried on with any degree of success. As told in the school geographies, the level of the city for the most part is from 6 ft. to 8 ft. below the level of the Mississippi River, which at this point makes a wide, sweeping bend, so that the city is practically surrounded on three sides by the river, whose waters are held back by levees. Throughout the greater part of the city, and especially along the water front, the top soil is a deposit of river silt left from the time when the river flowed unconfined over the area. Under the stratum of silt is one of clay, a comparatively hard clinging material when dry, but when wet forming a treacherous, unreliable mud, prone to wedge and cave-in when excavations are made. Rock strata are unknown. The levees may serve to prevent the current of the river from encroaching upon the city, but they have little effect in preventing the seepage of water, and the sub-soil throughout the entire area of the city is so thoroughly impregnated with moisture that a hole dug at any point will practically fill with water within the hour. In spite of these conditions a number of important engineering undertakings are now being carried on successfully, but as can be readily imagined, only by the employment of methods originated for this particular locality. The most important of these undertakings from the standpoint of the city, is the complete new system of sewerage and drains now nearing completion. From a street railway standpoint, the new methods of constructing the foundations of power houses and new track work are of special interest.

The other striking feature in New Orleans is the street railway situation on Canal Street. Canal Street is a broad thoroughfare, 137 ft. from curb to curb, and is the main business street of the city. All of the street railway lines in the city concentrate upon the lower twelve blocks of this thoroughfare. A raised strip 60 ft. wide in the center of the street, known as the neutral ground, is given over exclusively to electric railway tracks, and in the congestion district there are five parallel lines of track, the two outer lines being built to double gage and the inner line being for switching and layover purposes. During rush hours about 350 cars pass in each direction per hour in and out of Canal Street. That is, if a given point anywhere in the ten or twelve blocks constituting the congested section should be occupied by an observer, he would be able to count in the neighborhood of 700 cars per hour passing on the five tracks. To further complicate the situation, at every cross street in the twelve blocks there are double or single track curves by which some one of the lines enters or leaves Canal Street, and these curves, of course, have to cut all of the other main tracks. At each block the cross streets cut across the neutral ground, giving a passageway for teams and pedestrians. This situation is probably unparalleled in any other large city. In spite of difficulties, the cars are operated in and out with clock-like regularity and, what seems more remarkable, the accident account on this particular stretch of street is lower than anywhere else on the system. This freedom from accidents is probably due in part to the stationing of policemen and inspectors at each cross street during rush hours and partly to the fact that when using this section of Canal Street, both street railway employees and the public are keenly alive to the situation, and are keyed-up to a high pitch of watchfulness and precaution. The methods of operating on Canal Street will be more fully described in an early issue of this paper.

The New Orleans Railway & Light Company now operates all the street railways in the city of New Orleans. This company and its constituent companies have a street-railway franchise for about 50 years, a contract to furnish municipal lighting to the city for a period of 10 years from Oct. 1, 1905, furnish current for residential and commercial lighting and sell a large amount of current for power purposes to private corporations and individuals. The company also has the exclusive right to sell gas in the city of New Orleans until 1926.

During the past three years, the property has passed through a receivership under the management of E. C. Foster, formerly general manager of the Massachusetts Electric Companies, of Boston. The outstanding securities have been scaled down and the property has been placed on a firm financial basis. About $3,000,000 are being expended on physical improvements, and under the present management the company's prospects give promise of an exceedingly bright future. New Orleans now has a population of about 340,000 and the 180 miles of electric railway track are well located to serve the business and residential sections to the best advantage. Despite the loss of traffic due to the recent yellow fever scare, the gross earnings of the railway system showed an increase over the corresponding period of 1905, for the first 30 days of January, 1906, of $53,500.

As regards power facilities, the rapid increase in the company's business has taxed the generating station capacity to the utmost, and the present demand for power very closely approaches the load that had been estimated for 1908. Extensions of considerable magnitude are being made at the two main power stations, one known as the Market Street power house and the other as the Claiborne plant. The addition to the Market Street station will include three 1500-kw and one 5000-kw Curtis turbo-generating units. Many of the engineering features in connection with the work at both plants, especially the condenser layouts, are unique and of considerable interest. The work will be described in full in an early issue of the Street Railway Journal.

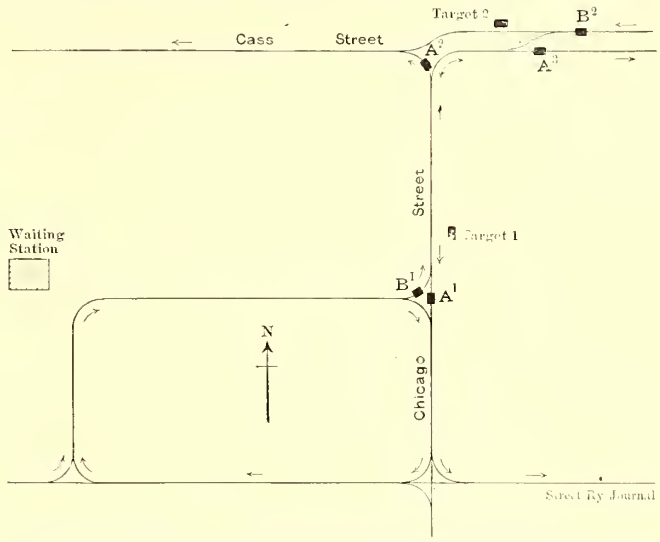
A considerable portion of earnings is now being expended on maintenance of track and lines, and in addition several miles of track are being entirely reconstructed. Owing to the nature of the soil it has been the practice in New Orleans to put a layer of 1-in. planking underneath the ballast. This planking serves to distribute the weight of the track and ballast evenly over the surface of mud upon which all tracks in the city are laid. Many miles of track laid in this way have been down ten to twelve years, and are still in good condition, despite the unstable foundation.

The company is now awaiting the arrival of seventy-five new cars recently ordered, and these, with the improvements in all departments now completed or under way, will enable the company to take full advantage of the tide of growth, prosperity and commercial activity, which is rapidly carrying New Orleans to her rightful position as the Queen City of the New South.

The Chicago Post Office has arranged to use the Chicago freight subway, between the La Salle Street railroad station and the post office, for mail transportation. This marks the opening of the underground mail system, which eventually will be opened between the main post office and all the railroad stations.

BLOCK SIGNAL SYSTEM IN JOLIET

An ingenious application of Eureka electric automatic signals for protecting a short section of single track in Joliet has recently been installed by J. R. Blackhall, general manager of the Chicago & Joliet Electric Railway Company. The accompanying diagram shows a portion of the railway system in Joliet. The double track on Cass Street, east of Chicago Street, is the main outlet to the east and north of the city, including the line to Chicago and Lockport. All cars coming over this line into the city use the cross-over, then pass down Chicago Street and around a loop. They return through Clinton Street to the single track on Chicago Street, and then go out east and west on Cass Street. The piece of track on Cass Street, between the cross-over and the track on West Cass Street, is not used.



PLAN OF TRACKS ENTERING JOLIET FROM CHICAGO, SHOWING THE LOCATION OF THE BLOCK-SIGNAL TARGETS AND CONTACT MAKERS

The signals of the Eureka car-counting system are located at the points marked "Target 1" and "Target 2." When the cars coming in on Cass Street reach the cross-over and find Target 2 clear, they pass through contact marker B^2. This sets Target 1 at "danger." If only one car goes through the block, it clears the signal when it passes the contact maker A^1. Cars going in the opposite direction set Target 2 to "danger" when they pass contact maker B^1. If the car is one which passes out east on Cass Street, it will clear the block when it passes contact maker A^3, or if it is going west it will clear the block when it passes contact maker A^2. At certain hours of the day there are three cars leaving the loop going west on Cass Street and two cars going east on Cass Street. When this occurs, Target 2 is set by the first car passing B^1, and is not cleared until all the cars which have passed B^1 have also passed over A^2 or A^3. Contact maker B^1 is set on the curve so that it is not operated by cars not using the single-track section described.

Before the installation of this signal device, the Chicago & Joliet Railway Company was obliged to maintain a flagman at the corner of Cass and Chicago Streets on Sundays, holidays and other days when the travel was heavy. The installation of signals has therefore saved considerable expense and annoyance. The signals have been in operation about two months.

The American Railways Company, which owns the Joliet system, has also been using, since the spring of 1905, the Eureka automatic signal system on its Altoona & Logan Valley Railway, where it has seventeen sets of signals, counting cars up to twenty-five in number.

CORRESPONDENCE

GUARANTEES ON POWER PLANTS

Feb. 14, 1906.

EDITORS STREET RAILWAY JOURNAL:

As regular readers of your journal, we are interested in the editorial entitled "Guarantees on Power Plants," in your issue of Jan. 20. We entirely agree with you that the cost per kw-hour is the vital point for power stations, but we also believe that guarantees can be no real substitute for expert knowledge. Any competent engineer has the records of the principal stations of the world available, and he can find out exactly how low costs per kilowatt are attained, and can select each item of the plant on commercial results. But if he insists on putting the entire equipment in the hands of one contractor, in order to get a thorough guarantee, he must inevitably take what they make; and no one concern makes the best boiler, the best stoker, the best heater, the best engine or turbine, and the best generator.

In this age of specialization, it seems only reasonable to expect a firm making one line of apparatus, say stokers or engines, and manufacturing nothing else, to be more efficient in that line than a firm ready to make anything. Our experience is that many of the big contracting firms make or buy the cheapest accessories, and that their guarantees are so limited that, as you say, they can be dodged. We have always urged investigation of operating results, as limited guarantees can be fulfilled under special conditions that bear small relation to operating practice. We consider guarantees a most undesirable basis for business, the only safe guide being operating results. Many engineers are very fond of guarantees, but the largest and most successful companies do not care for them, and insist on judging for themselves before buying; consequently they are able to buy cheaper, and the business is much more satisfactory on both sides. We think you should warn your readers against accepting any guarantees as a substitute for actual knowledge and study.

MANUFACTURER.

PILOTS ON INTERURBAN CARS

New York, Feb. 12, 1906.

EDITORS STREET RAILWAY JOURNAL:

It might be of interest to learn the opinions of the interurban managers on the above subject. Are they worth while or not? Abroad, the question would be answered in the negative almost unanimously. The Englishman never could see, and probably never will see, any good reason why the American equips all his steam locomotives with them. In the early days, when cows considered that the juiciest weeds and the best grazing were to be found on the right of way, they served their purpose by "catching" large numbers of these four-legged trespassers. Of late years they have apparently done little good beyond tossing men off the track, and occasionally scattering a pile of ties maliciously placed there, sometimes thus escaping derailment. Possibly that is sufficient reason for their retention. At any rate, they are probably here to stay for the sake of tradition, if not because the law requires them in most States.

Formerly the locomotive pilot was a well-designed, graceful looking affair, and added much to the general appearance of the engine. That was before the law prohibited the use of the long coupling bar, which was carried on the center of the pilot and was lifted up to the car coupler, and the pin dropped through the hole in its end when in use. When the M. C. B. vertical plane coupler had to be fitted to the engine front, it could not be made as long as the old coupling bar, and the longer it was made the worse it looked. The only recourse then was to shorten the pilot, because in coupling to other cars, especially freight cars with outside brake beams and tenders with the same, the point of the pilot struck the brake beam before the coupling could be made. The writer has spent many hours trying to design a good looking pilot under these limitations of space, and with the necessity of leaving a large square hole in the center for the coupler. The air-brake couplings pass through the slats and add nothing to its appearance. The result is that while some roads do better than others in their designs, the pilots all have that short, stubby character, which cannot easily be prevented. The standard height above the top of the rail, on different roads, varies from 5 ins. to 7 ins.

If the interurban car should be equipped with a pilot, or pilots, should it be attached to the buffer beam and project ahead of it? or should it be beneath the platform, with the point little, if any, in advance of the buffer? In either position, why should it not be armored with sheet steel or filled in with wood in winter and used as a snow plow? In the writer's opinion, that is one of the best reasons for its adoption. Are there any laws compelling its use on interurban roads? Interurban cars, running double-ended, frequently have trouble with snow piling up beneath the rear pilot, unless its point can be raised several inches and lowered again when going the other way.

Most interurban pilots are of the flimsiest, weakest construction imaginable; some are not even made of hard wood. They are often seen without any heel braces, the most important element in their design if they are expected to push anything off the track without collapsing. If pilots are made of wood, the strength should be in the bottom triangle, making the heel beam or rear side of the triangle substantial enough to attach one or two heel braces, which lead upward and backward to the car body. Pilots made entirely of iron, which are the standard on some steam roads, would look well on interurban cars, and would probably answer the purpose as well as wood.

If interurban cars are intended to run double-ended, and be coupled together, or haul trailers, the pilot must go under the platform, which seems to be the best place for it under any conditions.

E. C. BOYNTON.

FIGURES ON CAR LUBRICATION

THE CALUMET ELECTRIC STREET RAILWAY COMPANY OF CHICAGO

Chicago, Feb. 20, 1906.

EDITORS STREET RAILWAY JOURNAL:

Relative to comparative figures for the cost of lubrication of cars, it is impossible from published figures to get any comparative results. It occurs to me that the better method would be to figure the ton-journal mile, or for convenience, possibly 1000 miles. By this, of course, I mean what it would cost to lubricate one journal per ton per 1000 miles. A further distinction should be made between surface and elevated roads. I believe, if you start this agitation, it will result in some tangible method by which we could make comparisons.

H. M. SLOAN,
General Manager.

The Knoxville Railway & Light Company is completing the erection of a large car house which has been designed and is being erected by Ford, Bacon & Davis. The car house measures 300 ft. x 75 ft., and is divided into two bays separated by a fireproof wall. Adjoining the car house are some repair shops 100 ft. x 200 ft.

A NEW TYPE OF GASOLINE-ELECTRIC CAR

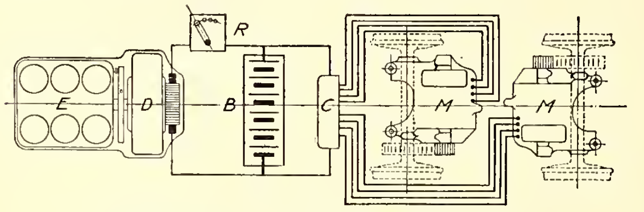
The gasoline-electric car shown in the accompanying illustrations was recently built for the Strang-Electric Car Company, of New York, by the J. G. Brill Company. Trial trips have been made over the main line of the Baltimore & Ohio Railroad, between Philadelphia and Wilmington, and officials of that railroad, of the Pennsylvania Railroad Company, of the American Locomotive Company, and prominent railway men from New York and elsewhere, have made up the parties and have watched the operation of the car with interest. This car has left the car works at Philadelphia on a trip to the Pacific coast by way of the Pennsylvania Railroad to Jersey City, the West Shore and New York Central lines to Buffalo, Lake Shore & Michigan Southern to Chicago, from Chicago over the Chicago, Alton & Rock Island Railroad to St. Louis and Kansas City, then over the St. Louis & San Francisco Railroad and Southern Pacific to San Francisco. The return trip will be made over the same route to Chicago, and from there over the Pennsylvania Railroad to Philadelphia. The Brill Company is building other cars of the same type for this company, which will measure 52 ft. 9 ins. over the vestibules. These cars will have smoking and passenger compartments and are to be mounted on high-speed trucks of the No. 27-E type. They are for use on the line of the Missouri & Kansas Interurban Railway, running over the Santa Fe trail from Kansas City, Mo., to Olathe and southwestern Kansas.

The Strang-Electric Car Company believes that the system which it has perfected will meet all the requirements for independent operation. The system combines a gasoline engine, generator and storage battery. The engine furnishes the power to run the generator, which generates electricity for the truck motors, and the storage battery receives the surplus power from the generator, when the load is light, to furnish automatically the excess power required during acceleration and on steep grades. The use of a generator and motors to transmit power between the engine and the wheels of a motor car may, to many, seem unnecessary. This combination, however, has proved highly satisfactory. Considered merely as a clutch and change gear, it is superior in simplicity and economy to any mechanical appliance for a similar purpose. The advantages of the gasoline engine over other prime power producers, are its light weight and economical operation. The reasons which are given for not driving the car directly by a gas engine are, first, that a practical means of transmission has never been discovered, as the gear and friction clutches used in automobiles are not suitable for a heavy car for railroad use, because they have no elasticity in starting and are unreliable; second, that direct operation by a gas engine requires one which is large enough for the highest possible demand, regardless of the average power required, as there is no reserve power for temporary overloads; and third, the difficulty of starting a direct-connected gas engine is a serious obstacle, since it must be done by the application of extraneous power. Therefore, while the gas engine is the lightest and most efficient power producer, the difficulty of its control renders direct connection with the axles impracticable. By combining the two systems, using the gasoline engine for primary power, electric transmission and control taking care of the peak of the load of the storage battery, it is claimed that an ideal system for independent electric cars is obtained.

The general plan of the system is shown in the diagram, and consists of a gas engine with a direct-conected generator, electric transmission and control, direct connection between the generator and the truck motors and a storage battery. Attention is particularly directed to the fact that this system requires an engine only large enough to develop the average power used. The engine was built by the Strang-Electric Car Company and designed by its chief engineer, Lars G. Nilson, is of the four-cycle type and has six 8-in. x 10-in. cylinders.

SPECIAL CAR OPERATED BY THE GASOLINE SYSTEM

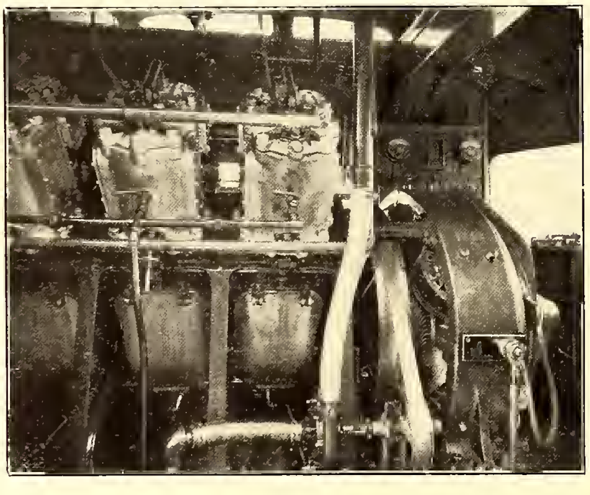
To secure a short crank shaft and reduce vibration to the minimum, the cylinders are partially opposed, three on each side, and are set at an angle of 90 degs. to each other. An advantage of this construction is in the accessibility of the parts. The bearings and wearing surfaces in general are much larger than customary, but the weight of the entire engine is reduced by using aluminum for covering parts where there is no strain. The engine frame is a substantial cast-steel structure, securely bolted to a rectangular base of the same material. The vaporizer is arranged to work with the utmost economy with all kinds of loads. Kerosene, alcohol or crude oil may be used instead of gasoline with a slight change of adjustment of the vaporizer. The ignition is of high-tension, or "jump spark" type, with coils of a special design, one coil for each cylinder, and all operating from one interrupter. The commutator is driven from the end of the cam shaft and is outside the casing at the rear of the engine. The oil is contained in a reservoir placed beside the base of the engine and pumped to the different bearings; it is returned to a filter located over the reservoir. A centrifugal pump, belted to the fly-wheel, draws water from a tank in the vestibule at the center of the car and forces it through the cylinder jackets and to radiating pipes upon the roof. In cold weather, the passenger department is heated by the water from the cylinder jackets. The gasoline is stored in a tank underneath the car floor, is pumped to an overflow cup at the side of the vaporizer, and the excess returned by another pipe to the tank. The cells of the storage battery are placed on a cradle underneath the center of the car. By the use of 250 volts, instead of the usual 500, the number of cells is reduced and a more reliable insulation secured. The electrical equipment consists of a 50-kw 250-volt d. c. generator, 400 r. p. m. directly coupled to the gasoline engine; two 50-hp series-wound motors of standard railway type, two K-13 controllers; and a storage battery of 112 cells having 200 amp.-hours capacity.



GENERAL PLAN OF THE STRANG SYSTEM

E—Engine B—Battery M M—Motors
D—Dynamo C—Controller R—Starting Rheostat

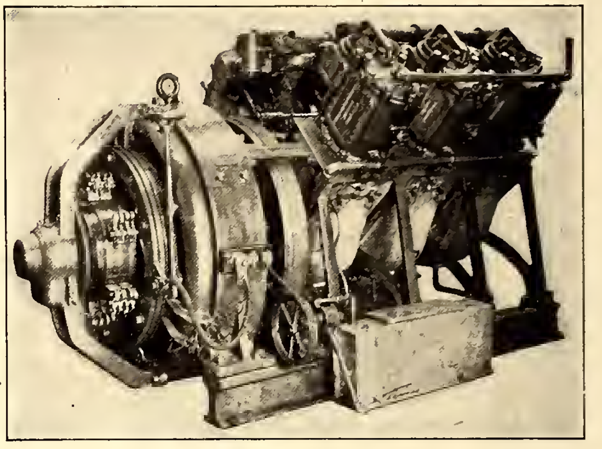
In the gasoline-electric system adopted, the inclusion of the storage battery enables the engine to run practically at the same speed at all times, with the air and fuel adjusted once and for all for the best possible combustion. As to preventing the battery from being overcharged while



A VIEW OF THE ENGINE THROUGH THE SIDE DOOR

running with a light load, it will be remembered that it requires a pressure of two and one-half volts to charge a storage battery, while during discharge the pressure falls to about two volts. The average voltage supplied to the motors practically corresponds to their rating and, therefore, with a light load they will run faster in the endeavor to use it up, while with a heavy load the voltage will fall sufficiently to allow the batteries to assist the engine in furnishing the necessary current. In other words, the electric transmission being elastic there is always a tendency to adjust the speed of the car to that which is most suitable and economical for the primary power equipment. Moreover, the engine is provided with automatic governing devices dependent entirely upon the condition of the batteries and the consumption of current. This arrangement has nothing to do with the speed of the engine or the motors, but is simply an additional safeguard against overcharging the batteries, is entirely automatic and solely for the purpose of economizing fuel and saving the battery when the car is running light or standing still.

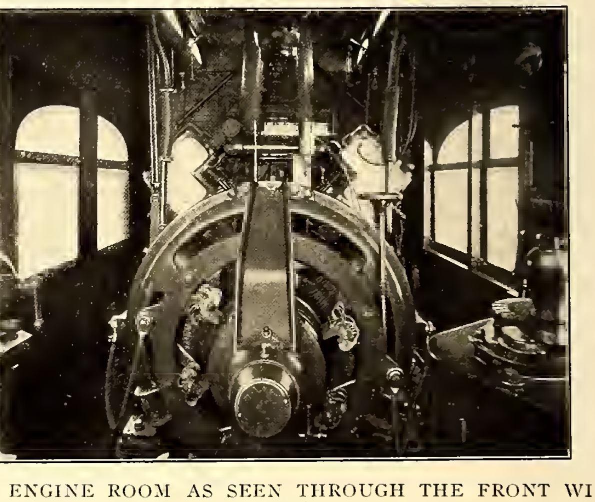
The switchboard is placed against the left side of the engine compartment within easy reach of the operator. It includes a voltmeter, ammeter, starting rheostat and spark control. The platform at the rear of the car is equipped with



GASOLINE ENGINE WITH DYNAMO

a controller and a combination volt and ammeter. The maximum speed of the car which can be maintained is 50 m. p. h. The average gasoline consumption is 0.45 gallon per car mile. One hundred gallons of gasoline are carried, which gives a mileage radius of 225 miles.

The car illustrated measures 36 ft. 6½ ins. over the body, and 41 ft. 6½ ins. over the crown pieces; width over the sills, including the sheathing, 8 ft. 4 ins. The passenger compartment is finished in mahogany, richly carved and inlaid. The ceilings are of the semi-empire style, tinted light green and decorated with gold. A handsome rug covers the

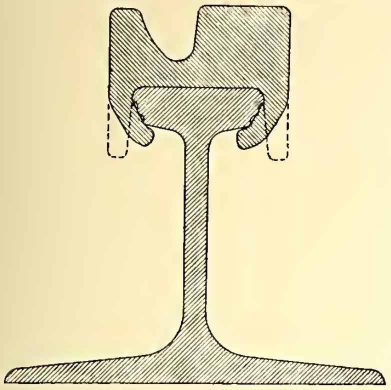


THE ENGINE ROOM AS SEEN THROUGH THE FRONT WINDOW

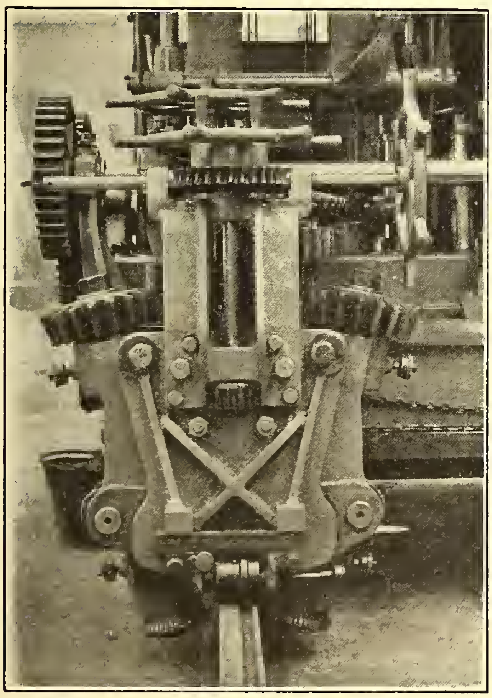
hardwood floor and silk curtains and draperies and rich upholstering, all of a dark green color, make a very attractive interior. Between the engine room and the passenger compartment is a small compartment separated by sliding doors with glass in the upper part, in which are located a toilet room on one side and a closet on the other. The large observation platform at the rear end has trap doors to close over the step openings, and a dasher and gates composed of old brass grill work. The car is mounted on No. 27-E-1½ high-speed trucks with steel-rolled wheels.

NOVEL COMPOUND RAIL

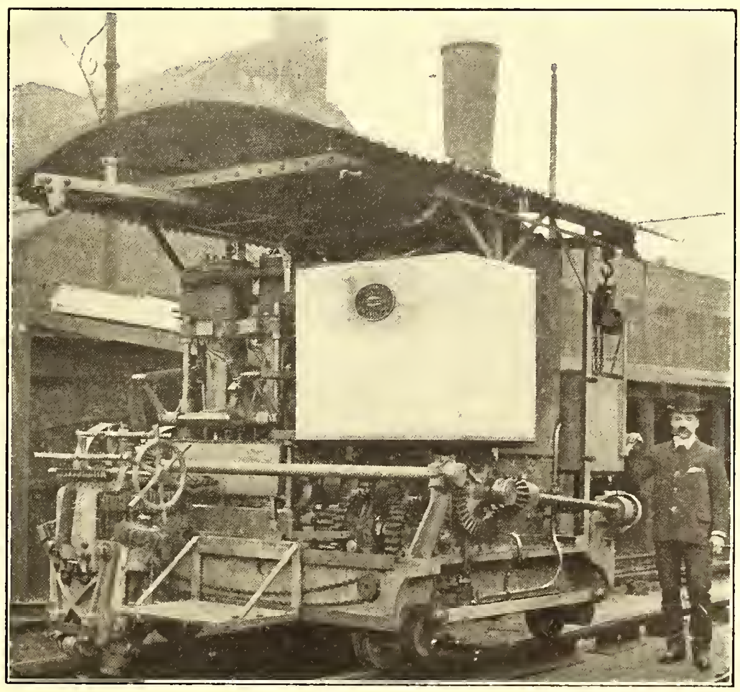
A new type of compound rail for street railway service has recently been developed by the Romapae Tramway Construction Company, of Leeds, England. It consists, as shown in the accompanying section, of a lower portion, which is 59 per cent of the whole, and which is a permanent fixture, and an upper portion which is 41 per cent of the whole, and which is a renewable part, cold-welded upon the lower part. The under girder is laid in the usual way, and the upper portion is attached by the rolling-on machine illustrated in the accompanying engraving. The head or upper portion can be laid in 30 ft. or 60 ft. lengths, and break joints half-way between the joints and the lower girder. When the upper part is worn out it can be removed by a special attachment to the machine illustrated. The rollers are exchanged for a disc cutter on one side and a straight fluted roller on the other, and the groove, ¼-in. deep, is eut in the outer flange. The top is then pulled off by the machine without injuring or disturbing the lower girder. The capaeity of the machine for rolling on the top section exceeds 10 ft. per minute.



SECTION OF COMPOUND RAIL



END VIEW OF ROLLERS



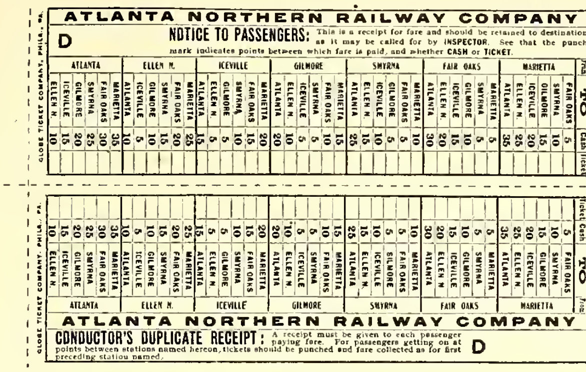
MACHINE FOR ROLLING HEADS OF RAILS ON SUPPORT

The company laid a short section of tracks in Leeds last October, and J. B. Hamilton, general manager of the Leeds City Tramways, says that he considers it effective, and that it shows an economy of 53⅓ per cent over ordinary rail.

It is announced that the Washington Heights section of the New York Subway, which has been six years in building, will be opened for regular passenger trains some time this week. This part of the Subway is cut through solid rock at a depth below the surface from 100 ft. to 125 ft.

SIMPLE DESIGN FOR DUPLEX TICKET

The Atlantic Northern Railway Company, operating a 20-mile electric line out of Atlanta, Ga., is using a duplex-fare receipt ticket, the face of which is so designed that the conductor can indicate by a single punch mark all the information required to make the reeeipt valid, including the points between which the passenger has paid fare, the amount paid,



GLOBE TICKET COMPANY, PHILA., PA.

ATLANTA NORTHERN RAILWAY COMPANY

D **NOTICE TO PASSENGERS:** This is a receipt for fare and should be retained to destination as it may be called for by INSPECTOR. See that the punch mark indicates points between which fare is paid, and whether CASH or TICKET.

From	To / Cash					
ATLANTA	ELLEN N. 10	ICEVILLE 15	GILMORE 20	SMYRNA 25	FAIR OAKS 30	MARIETTA 35
ELLEN N.	ATLANTA 10	ICEVILLE 5	GILMORE 10	SMYRNA 15	FAIR OAKS 20	MARIETTA 25
ICEVILLE	ATLANTA 15	ELLEN N. 5	GILMORE 5	SMYRNA 10	FAIR OAKS 15	MARIETTA 20
GILMORE	ATLANTA 20	ELLEN N. 10	ICEVILLE 5	SMYRNA 5	FAIR OAKS 10	MARIETTA 15
SMYRNA	ATLANTA 25	ELLEN N. 15	ICEVILLE 10	GILMORE 5	FAIR OAKS 5	MARIETTA 10
FAIR OAKS	ATLANTA 30	ELLEN N. 20	ICEVILLE 15	GILMORE 10	SMYRNA 5	MARIETTA 5
MARIETTA	ATLANTA 35	ELLEN N. 25	ICEVILLE 20	GILMORE 15	SMYRNA 10	FAIR OAKS 5

Ticket

GLOBE TICKET COMPANY, PHILA., PA.

From	To / Cash					
ATLANTA	ELLEN N. 10	ICEVILLE 15	GILMORE 20	SMYRNA 25	FAIR OAKS 30	MARIETTA 35
ELLEN N.	ATLANTA 10	ICEVILLE 5	GILMORE 10	SMYRNA 15	FAIR OAKS 20	MARIETTA 25
ICEVILLE	ATLANTA 15	ELLEN N. 5	GILMORE 5	SMYRNA 10	FAIR OAKS 15	MARIETTA 20
GILMORE	ATLANTA 20	ELLEN N. 10	ICEVILLE 5	SMYRNA 5	FAIR OAKS 10	MARIETTA 15
SMYRNA	ATLANTA 25	ELLEN N. 15	ICEVILLE 10	GILMORE 5	FAIR OAKS 5	MARIETTA 10
FAIR OAKS	ATLANTA 30	ELLEN N. 20	ICEVILLE 15	GILMORE 10	SMYRNA 5	MARIETTA 5
MARIETTA	ATLANTA 35	ELLEN N. 25	ICEVILLE 20	GILMORE 15	SMYRNA 10	FAIR OAKS 5

Ticket

ATLANTA NORTHERN RAILWAY COMPANY

CONDUCTOR'S DUPLICATE RECEIPT: A receipt must be given to each passenger paying fare. For passengers getting on at points between stations named hereon, tickets should be punched and fare collected as for first preceding station named. D

CONDUCTOR'S RECEIPT USED ON ATLANTA NORTHERN RAILWAY

and whether cash or ticket was given. As will be noticed from the sample ticket reproduced here, this faeility of punching is secured by printing on the face of the ticket all the possible combinations from and to all stations, with the rate of fare at the side of each combination, so that by making one punch mark either in the column headed cash or the one headed ticket, all the desired information is indicated. On this particular line there happen to be only seven stations, including the two terminals, and there is room to print the seven different sets of combinations. The idea would hardly be applicable on a line having very many more stations or fare zones, unless the printing was made much smaller or the ticket much larger.

It is not claimed that the design insures any greater safeguards than the usual form of duplex reeeipt. The aim is merely to reduce to the minimum the work of the conductor in issuing the ticket. On this road the receipts are not dated but the accounting is done by the consecutive numbering on the tickets. It is held that no material object is gained by numbering conductors' receipts as the receipts are only good for a single trip, and should a passenger when asked for a fare present an old receipt, claiming he had paid his fare, the conductor is able to tell by the serial number whether or not the receipt was issued on the current trip.

As used, the conductor's coupon is surcharged with the word "Duplicate" printed in red.

NEW EQUIPMENT FOR AN ARIZONA RAILWAY

The type of car shown in the illustrations is one which has lately been delivered to the Prescott (Ariz.) & Mt. Union Railway Company (Ariz.), by the American Car Company.

CONVERTIBLE CAR, OPEN

The railway is a new line which runs between the city of Prescott and Mt. Union, an important mining point a few miles

CONVERTIBLE CAR, PARTLY CLOSED

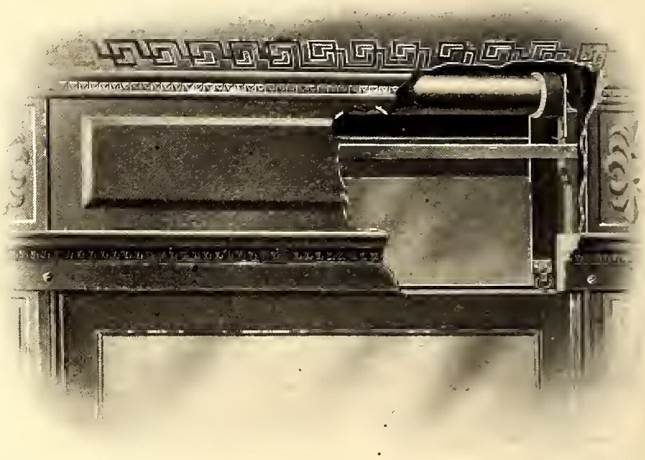
distant. In summer, the days are hot but the evenings quite cool, and, therefore, a car of the convertible type, which

INTERIOR OF PRESCOTT & MOUNT UNION CAR

can be changed from closed to open and vice versa in a few minutes, is particularly suitable. The car is of the Brill type and measures 20 ft. 7 ins. over the body and 30 ft. over the vestibule; width over the sills, including the sill plates, 7 ft. 6½ ins., and over the posts at the belt, 8 ft. 4½ ins.; sweep of the posts, 5 ft; distance from the center to the center of the side posts, 2 ft. 7 ins.; height from the floor to the ceiling, 8 ft. 7 ins.; from the track to the under side of the side sills, 2 ft. 5⅜ ins., and from the sills under the trolley board, 9 ft. 5⅞ ins.; height from the track to the platform step, 14 ins., and from step to the platform, 12 ins. The side sills are 5⅛ ins. x 5½ ins.; the wheel pieces, 5¾ ins. x 7 ins., and the end sills, 4¼ ins. x 6 ins. Z-iron bars, 3¼ ins. x 5-16 ins. are inside of the side sills and rest upon the wheel pieces. The car is mounted on No. 21-E trucks, with 7 ft. 6 in. wheel base and 4 in. axles. Two 25-hp motors are used. The weight of the car and the trucks without the motors is 15,300 lbs. The seats, platform gongs, bells and other specialties are of Brill manufacture.

A PRACTICAL SASH BALANCE

The National Lock Washer Company, of Newark, N. J., is making a very neat device, known as the National sash balance, which, as its name implies, is used for balancing the weight of the sash. It is a specially made spring roller, which is held in brackets at the highest part of the sash slide. It is placed out of sight, and so made that it is impossible to get out of order. This roller is held to the sash by two belts, one at each end of roller. These belts are connected with the roller by brass straps locked in groove of roller, and the lower ends connected to the sash by hooks secured to the belting by



CUT-AWAY VIEW, SHOWING SASH BALANCE

brass straps. These hooks fit into eyes which screw into top of the sash, thus making it easy to take out the sash when necessary. The screw eyes can also be raised or lowered one or more turns to equalize the belt on each side. If a stronger tension is required, one belt at a time can be unhooked and passed around the roller. If less tension is required, belt can be unhooked and one turn taken off, making it unnecessary to ever take roller down to regulate or adjust it. All of the wearing parts are of sheet brass, making it practically indestructible. The movement of the sash with this balance is easy and noiseless. The belting connections are simple and strong, and do not come in front of the glass where upper sash is used. It is easily fitted to sash and takes up little space. This device operating with the company's National sash lock, automatically locks the window at any height. This balance can be adjusted to any weight of sash, so that when levers of the lock are released, sash will be raised at once.

BLOCK SIGNALLING ON THE GREAT NORTHERN & CITY RAILWAY

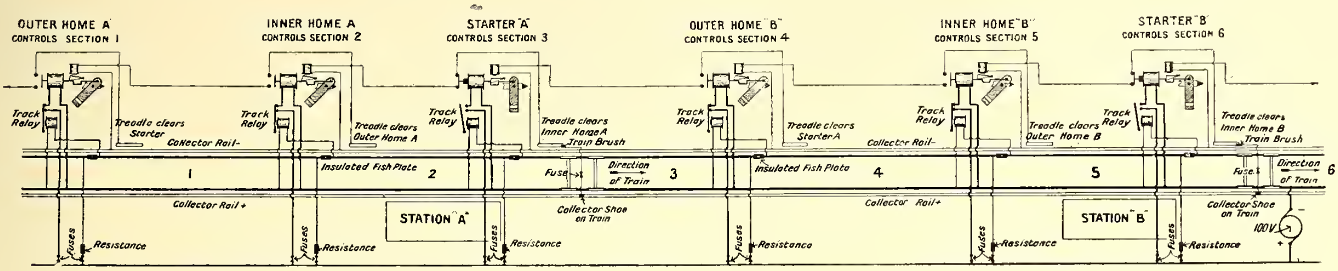
An electric block-signal system, with a number of novel features, has recently been installed by the Automatic Block Signal Company, on the system of the Great Northern & City Railway, of London. This company operates one of the latest underground electric railways of London, and its system was described in the Street Railway Journal for March 5, 1904.

As it was considered desirable on underground railways to do away as far as possible with moving parts in the running tunnels, where restricted clearance and frequent train service allow of no time for inspection along the track during traffic hours, the system was so arranged that all the controlling and moving apparatus are installed in the signal towers, where the essential parts are accessible at all times and can be seen in operation and easily maintained. The signalling is automatic at through stations, and semi-automatic at stations equipped with switches and crossings and at terminals.

The running rails on the Great Northern and City Railway are not utilized as a return for the train current, and therefore were available and have been used for the track-circuit signal control. Both running rails are bonded, one rail being bonded continuously, and the other bonded and divided up into sections to correspond with the sections controlled by each signal. Simple direct-working relays are placed across the track rails at one end of each section, and the current is fed in at the opposite end of each section, at a pressure varying from 3 volts to 7 volts. This current is supplied from a 100-volt generator, and the pressure is reduced by lamp resistances between the 100-volt main and the track rails. To guard against any irregular operation of the track relays by stray currents, a block-treadle control energized by the same current as works the trains was introduced. The track and treadle circuits can be said to be interlocked with each other in the same manner as an ordinary mechanical semaphore signal is pulled off by two signalmen from their respective boxes.

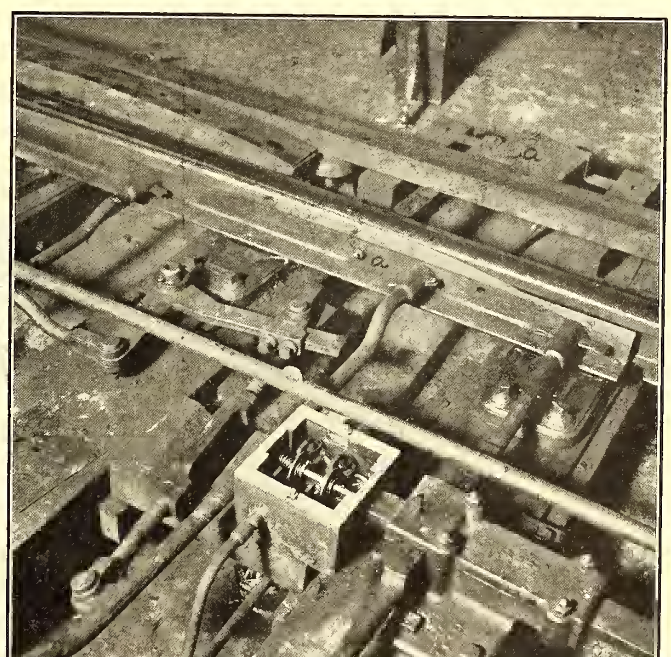
Thus, no signal can go to "line clear" unless a train has passed completely out of the block section and entered the next block to the extent of the overlap, which is usually about 350 ft. to 400 ft. or more, according to local conditions, as the tail brush is fixed on the last vehicle of each train. The contact of the treadle brush with the block treadle fixed alongside the track serves to remove the block from the signal to the section or sections in the rear. That is, the function of the track relay is to drop its armature, putting the signal to danger by opening the local signalling circuit when any pair of wheels enters the section it controls. Once the signal has gone to danger, it remains locked there by a stop which falls into place by gravity, and can only be removed when the train has passed the corresponding treadle in advance. It will be observed that should a train become derailed, or divided and leave a portion behind—a remote possibility on modern electric railways with air brakes running from end to end of the train—or should a single car be derailed in such manner that its wheels are free of the running rails, and the track relay being thus clear, the treadle control would still be there to protect the block, and provide an additional safeguard.

The diagram shows a train which, having entered a section, has placed the starter at danger, and the train treadle brush



DIAGRAMMATIC LAYOUT OF SIGNAL SYSTEM ON THE GREAT NORTHERN & CITY RAILWAY


TAIL BRUSH PASSING OVER TREADLE


SWITCH AND BOLT LOCK DETECTORS

in the act of clearing the lock on inner home signal in the rear. All the signals drop to danger should the 100-volt circuit fail. If the 500-volt circuit should fail, the passing of the train over a treadle will not energize the treadle, and, consequently, although the signal drops to red immediately behind the train, as it should, the signal controlling the section further in the rear also remains at red.

The tunnel signals contain no moving parts, and the red and green signals are given by the switching in and out of incandescent lamps behind fixed red and green bull's-eyes. The signals in the open are controlled and interlocked in exactly the same way as the tunnel signals with the addition of a semaphore arm worked by an electric motor. All signals are repeated back into the towers, a valuable feature which is found a great convenience in operation, as the position of the trains can be ascertained at once when required.

The operation of signals at termini and cross-over roads is semi-automatic, as the trains set the signals automatically to "danger" on entering the section, but the signalman puts the signals to clear by hand providing the road is properly set and the line clear. The signal circuit at these situations depends for its continuity on the road being set correctly both at the switches and in the signal cabin. A view on page 363 shows the switch detector attached to the tongue of the switch by means of an arm which works an electric contact switch, *a*. There are two such arms at each facing switch, one on each side of the switch, so as to turn the switch to the left or right. This, combined with the switch-lock detector *b* insures the signal coming off only when everything at the switches is in good working order.

The signal tower contains mechanical levers for the switches and the signal-controlling gear. One interlocks with the other, and the signalman is guarded against any error, on account of the actual working of the signals and road levers, being governed by the track circuit and the position of the trains. The correct location of the trains enables the right apparatus to become free for operation. The signal can be put to danger at any time when desired, but no signal can be put to clear by a signalman at either automatic or semi-automatic stations, and in the former case, only under special circumstances unless the road is clear and properly set.

The equipment was installed under the direction of R. P. Brousson, engineer and traffic manager of the line, by J. E. Spagnoletti & Co., contractors. Ætna insulators, supplied by R. W. Blackwell & Co., were used for the treadles.

SINGLE-PHASE EXTENSION IN MILWAUKEE

The Milwaukee Electric Railway & Light Company has recently placed an order with the General Electric Company, of Schenectady, N. Y., for a single-phase apparatus for the equipment of two extensions which the company is building. One of these extensions is from the present terminal of the Waukesha Beach line on Pewaukee Lake to Oconomowoc, and the other is an extension of the Muskego Lakes line from Muskego Center to Mukwonago and East Troy. The company has adopted single-phase electrical equipment for these outlying lines to avoid the necessity of additional power houses or sub-stations.

REPORT MADE ON THE SANITARY CONDITIONS OF THE NEW YORK SUBWAY

George A. Soper, Ph. D., consulting sanitary engineer of the Rapid Transit Commission, states that the average temperature in the Subway during last July and August was 5.6 degs. higher than in the streets, and that in the hottest week it was about 10 degs. higher. He does not consider this injurious to health, if the Subway is kept clean. There is only a slight decrease in the average amount of oxygen and a slight increase in carbon-dioxide as compared with the outside air, and of bacteria there were more than twice as many in the streets as in the Subway. Recommendations are made for improving the sanitary conditions.

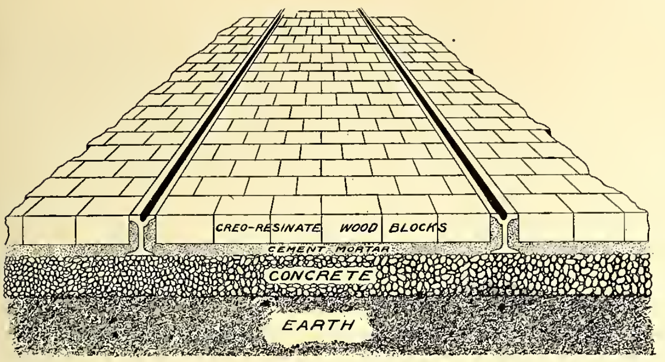
SEMAPHORE AT STATION

SIGNAL LANTERN AT STATION

SIGNAL LANTERN IN TUNNEL

CREO-RESINATE WOOD BLOCKS FOR PAVING

The recent decision of the city of New York to have over a mile of the busiest part of Broadway—from the Battery



CROSS-SECTION OF TRACK, SHOWING METHOD OF PAVING WITH WOODEN BLOCKS

to the Post Office—paved with treated wooden blocks, has resulted in one of the most important awards ever made for wood paving. The authorities of the metropolis had previously tried these blocks on a number of side streets, and as they proved satisfactory it was finally decided to give their manufacturer, the U. S. Wood Preserving Company, of New York, the Broadway contract mentioned. It is interesting to note that by this action in favor of wooden paving New York is following the example of such European cities as London and Paris, which have long recognized the merits of properly treated blocks as regards noiselessness, cleanliness and low maintenance cost. To street railway companies, this subject is of special interest as so many of them are burdened with the heavy ex-

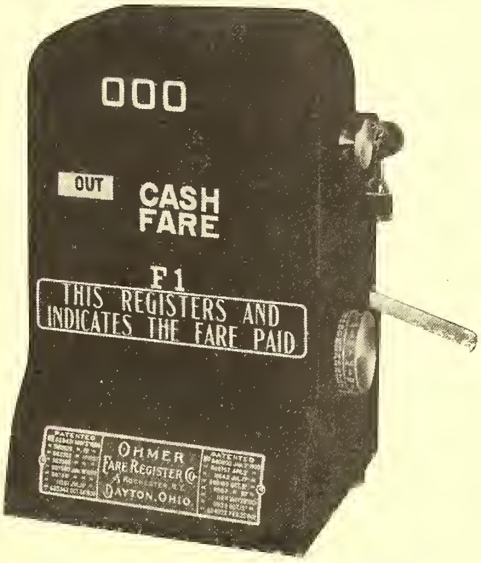
ALONG LEXINGTON AVENUE, NEW YORK, WHICH IS PAVED WITH CREO-RESINATE WOOD BLOCKS

pense incident to keeping in repair the asphalt or granite pavements between their rails, and, in particular, whenever track repairs of any kind are necessary.

The paving blocks furnished by the U. S. Wood Preserving Company are made of pine treated by the creoresinate process, which impregnates the blocks with a mixture of creosote and resin. The creosote acts as a preservative, taking the place of the sap in the wood, while the resin hardens the block, makes it waterproof and keeps the creosote from washing out or evaporating. These blocks are quickly laid, and can be easily taken up whenever track repairs are necessary. As they are made of wood, only an axe is needed to shape them for fitting into odd corners. In fact, no other form of paving can be taken up or laid so cheaply. The accompanying drawing has been prepared to show a standard roadbed covered with these blocks, and designed to withstand the most severe traffic. The half-tone illustration is a view on Lenox Avenue, New York, on which the New York City Railway Company operates one of its most important lines.

A NEW TWO-FARE RECORDING REGISTER

The Ohmer Fare Register Company, of Dayton, Ohio, has added to its several types of registers a two-fare recording machine, provided with total passenger indicating wheels, identification key, and printing device. It is of strong and



TWO-FARE RECORDING REGISTER

durable construction, and is easily operated by rod movement from either or both sides.

As its arms are adjustable, it can be attached to rods in all sizes of cars. It is built especially for heavy city work, and is the result of ten years of careful study and experience in the building of registers for street and interurban cars. The printed records from this type of register show all details desired by railway managements. They can be easily removed, are in very convenient form, and constitute a complete check over all the operations of the conductors.

NATIVE OPERATIVES ON THE MANILA STREET RAILWAY

The experiment made by the operating department of J. G. White & Company, through its resident general manager in Manila, H. A. Belden, in depending solely on native Filipinos to man the cars of the Manila Electric Railway, is proving eminently successful. It was feared in some quarters that a certain well-known tendency toward unreliability in the native character would manifest itself almost certainly in this work, more exacting than any natives had heretofore been called upon to perform in numbers since the American occupation, but thus far such fears have proven absolutely groundless.

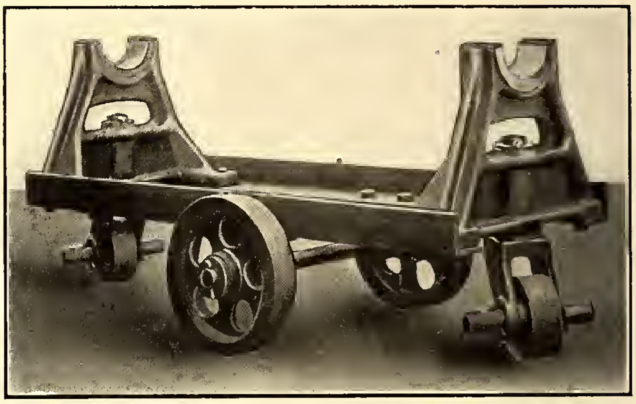
It must be remembered that to operate a modern electric car in the crowded streets of an Oriental city, where the traffic and pedestrians are absolutely at variance and unaccustomed to so foreign an element, calls for the full measure of steadiness and resourcefulness to avoid accident. It is a fact that under these trying conditions the Manila Electric Railway is being operated with what may be justifiably considered a minimum of accident. To appreciate fully the peculiar demand for steadiness, one must have had experience in trying to progress through the streets of a Far Eastern metropolis. Pedestrians use the roadway very often in common with vehicles, and may generally be pursuaded to make way only when their lives are actually endangered. A narrow escape from death is uniformly treated as a good joke, not only by the observers, but by the principal as well. Under the circumstances, the almost complete freedom from serious accident in the operation of the line is decidedly noteworthy. The conductors, too, uniformly show the ability to live up to the requirements of their work.

A GROUP OF NATIVE EMPLOYEES OF THE MANILA STREET RAILWAY

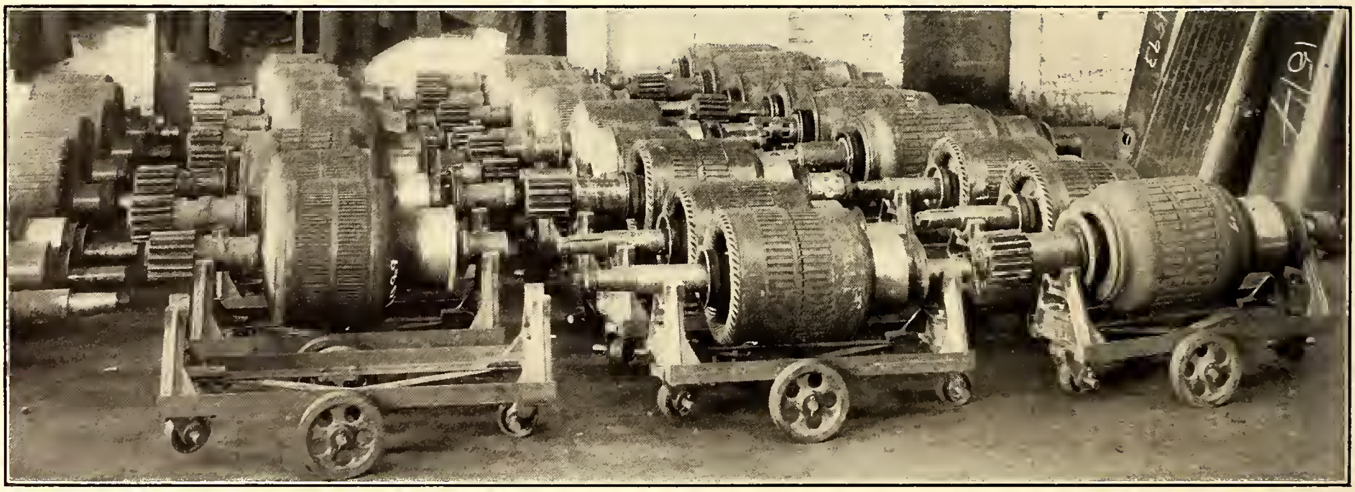
These facts are significant of the possibilities in the native Filipino character, when given just opportunity to display itself, and will prove especially interesting to Americans watching the industrial development of the islands.

A HANDY ARMATURE BUGGY

The American General Engineering Company, of New York, has recently designed a simple but effective truck for handling armatures. It will be seen from the accompanying illustration that the truck takes up hardly any more room than the armature, so that the armatures can be easily stored in accessible positions without coming into contact with nails, splinters or other odds and ends. The two side pieces are made of steel, and the gray iron end brackets which hold the armature shaft have babbitted bearings. The truck is carried on two 8-in. diameter wheels placed out of center to secure the tilting effect. These main wheels are constructed of cast iron. By bearing down on one of the malleable-iron pivot casters at the end, the truck and its load can be easily transported through the shops. Any number of these trucks can be operated with the aid of an interchangeable handle. It is not practicable to give any exact dimensions of this truck, as these depend entirely on the size of the armature. For accommodating armatures requiring inside distances of 28½ ins. and 33 ins. between bearings, the truck needed does not weigh more than 100 lbs.



ARMATURE TRUCK WITH BABBITTED BEARINGS



A GROUP OF ARMATURE TRUCKS, SHOWING THE PROTECTED POSITION AND ACCESSIBILITY OF THE ARMATURES

LEGAL DEPARTMENT*

INJURIES SUSTAINED THROUGH ELECTRICAL APPLIANCES

Officers of railroad companies are familiar with the duty of extraordinary care and special liabilities on the part of common carriers to passengers. With regard to danger of injury from electricity, very much the same measure of care and responsibility is exacted in behalf of all the world. Practically all the cases on the subject hold that those who supply or use electrical power or light must take extraordinary precautions to avoid injury to others. The reason for the rule is obvious in the occult, but extremely dangerous, nature of electrical currents. It was, for instance, held by the Supreme Court of Minnesota, in Gilbert vs. Duluth General Electric Company (100 N. W., 653), that electric companies are bound to use reasonable care in the construction and maintenance of their lines and apparatus. This care varies with the risks to be apprehended from negligence. Where the wires carry strong and dangerous currents of electricity, and the result of negligence may be exposure to death or serious accident, a high degree of care is required. Under such circumstances "reasonable care" and a high "degree of diligence" may be deemed to be synonymous. It was definitely decided that parties installing electric light fixtures in houses are not bound to anticipate that electric light companies furnishing electricity to the public will be negligent in either the construction or maintenance of their respective systems connecting therewith, and the installation of a defective electric socket by plaintiff's intestate at his place of residence did not constitute such contributory negligence as will preclude a recovery.

That the court will, however, impose some limit upon the responsibility of those who supply electricity was exemplified by the decision of the Supreme Court of Iowa, in Harter vs. Colfax Electric Light & Power Company (July, 1904, 100 N. W., 509). It appeared that a guest in a hotel was injured by an electric shock, owing to an electric light wire falling on him, but it also appeared that the wiring was not done by the defendant, the company furnishing the electricity. It was held that the doctrine *res ipsa loquitur* did not apply in the absence of evidence that the accident was due to a dangerous current knowingly, or even negligently, sent into the building, and, therefore, that there was no presumption of negligence on the part of the one furnishing the electricity, which it was necessary for it to rebut. In harmony with the decision in the Minnesota case (supra), however, the Iowa court conceded that the defendant company owed "to the owner of the property and to any person rightfully upon the premises, the duty of not sending into the hotel a deadly or dangerous current of electricity. Handling, as it did, a dangerous element, it was held to the highest degree of care in the construction, inspection, repair and operation of its plant and machinery; but it was not an insurer against all accident."

In the recent decision of the Supreme Judicial Court of Massachusetts, in Mahan vs. Newton Electric Railway Company (75 N. E., 59), the duty of extraordinary care was enforced against a street railroad company in behalf of the estate of a person other than a passenger.

It was held that the defendant might be liable for the death and conscious suffering of a lineman of an electric light company caused by reason of an electric shock received while engaged in putting a cross-arm to a pole of the light company. It was expressly laid down that a violation by a lineman of a rule of the electric light company employing him that linemen should treat every light wire as a live wire is not conclusive evidence of negligence, but only a circumstance to be considered with others. As to the general duty of care, the following language from the opinion is significant:

"The negligence relied on is the failure of the defendant to put up and maintain guard wires. There was evidence, which was objected to by the defendant, tending to show that it was customary to use such wires, and that they were in general use at the time of the accident, and that they were used to prevent other wires from coming in contact with the trolley wire, which was an uncovered wire, and thus becoming charged. The witness who testified to this admitted on cross-examination that some systems did not use such wires, and that they were not used in many important localities in this vicinity. The defendant was operating cars in the public streets by the use of a highly dangerous agency. It was bound to know that other wires were or might be strung along the streets for various purposes, and that persons would or might be employed to work upon them, and it was its duty, in the exercise of reasonable care, to adopt such precautions as were proper to prevent its own wires from coming in contact with the wires upon which such persons were or might be employed and injuring them. It was for the jury to say, taking everything into account, including the expense and practicability of guard wires and the way in which the trolley wire was put up, as to which there was evidence from the defendant, whether the defendant had performed this duty, and whether the plaintiff's intestate was injured and killed in consequence of its failure to do so. It could not be ruled as matter of law that there was no evidence of negligence on its part, or that the negligence, if any, had not resulted in harm to the plaintiff's intestate."

* Conducted by Wilbur Larremore, of the New York Bar, 132 Nassau Street, New York, to whom all correspondence concerning this department should be addressed.

CHARTERS, ORDINANCES, FRANCHISES.

ALABAMA.— Injunction — Trespass — Leases — Reservations — Exercise of Power—Construction—Street Railways—Character —Statutes—Constitution—Mandatory Provisons—Introductory Clause—Compliance.

1. Where a street railway's entry into complainant's park was lawful if properly made, and became unlawful only because it was that the entry was by force at the hands of one from whom the possession was wrongfully withheld, a court of equity, in the absence of irreparable injury from the mode of entry and occupation, would not protect the possession of one wrongfully seeking to withhold it, by injunction, but would leave such complaint to redress the forcible trespass by ordinary remedies.

2. Where a lease of land for park purposes reserved to the grantor the right to grant a right of way through the park for street railway purposes, mere acquiescence by the lessors in a prior entry of a street railway company into the park at the instance of the lessees, and its use of a part of the premises as a station for receiving and delivering passengers, did not constitute an exercise of the power reserved.

3. An electric railway, operating beyond the limits of a city, and into a town incorporated for the mere maintenance of a park adjacent to the city, was a street railway, within a power reserved in the lease of the land used for the park, reserved to the lessors the right to grant a right of way through the land "for street railway purposes."

4. Const. Ala., Section 45, providing that the style of laws of the State shall be, "Be it enacted by the Legislature of Alabama," is mandatory.

5. Under Const., Ala., Section 45, providing that the style of laws of the State shall be, "Be it enacted by the Legislature of Alavama," Act March 20, 1903 (Acts 1903, p. 116), amending Code, Section 1283, the enacting clause of which stated that it was enacted by "the Legislature of Alabama," was not defective because it also declared that "the Legislature of Alabama" which enacted the statute was "the Legislature of the State of Alabama."

ARKANSAS.—Street Railway Franchise—Authority to Revoke—Presentation of Question—Appeal—Supreme Court—Injunction—Power to Grant—Provisional Relief.

1. Where, in a suit to annul a street railway franchise conferred by ordinance providing that, before the franchise should be enjoyed, the company should obtain from the County Court a confirmation of the right of way over a bridge, the complaint alleged that application to the County Court to confirm the right of way had never been made, and the answer admitted the allegation, and the only proof was the testimony of the company's manager that no application was made to the County Court, and that he had believed that permission to cross the bridge would not be granted, the question of the authority to revoke the franchise on the refusal of the County Court to grant permission was not presented.

2. The Supreme Court, on appeal from a decree annulling a street railway franchise, has no authority to restrain the city from interfering with the tracks constructed under the franchise before the commencement of the suit, pending further proceedings by the company to test its rights under a municipal ordinance; that being a provisional relief to be awarded by the court in which the further proceedings are instituted, subject to review on appeal.—(Little Rock Ry. & Electric Co. vs. City of North Little Rock, 88 S. W. Rep., 1026.)

INDIANA.—Eminent Domain—Condemnation for Right of Way—Measure of Damages—Instructions—Evidence—Opinions—Value of Land—Appeal—Harmless Error—Rejecting Evidence—Damages—Evidence.

1. The instruction, in proceedings to condemn land for a railroad right of way, that the damages are to be determined by finding the value of the land remaining after the company has appropriated its right of way and built its road, and determining the value of the entire lot as it now is, and, deducting one from the other, the difference being the measure of damages, sufficiently states the measure of damages, the difference in value of the real estate at the time of the appropriation, and the value of the residue after the strip is taken.

2. A witness who has testified as to his knowledge of land in question is competent to give his opinion as to its value before and after appropriation of a right of way through it, basing his opinion on the facts to which he has testified, though he shows that he is not familiar with the value of lands in the neighborhood, and knows of only one transfer.

3. Rejecting testimony of a railroad company's witness that the damages from its appropriation of land for a right of way was only $200 is harmless; the company having introduced the testimony of many other witnesses that the damages were only from $45 to $150.

4. In proceedings to determine damages for condemnation of land for a railroad right of way, it is not error to admit evidence of a cut in the grade of the road along by the land in question.—(Consolidated Traction Co. vs. Jordan (No. 5489), 75 N. E. Reporter, 301.)

ILLINOIS.—Eminent Domain—Form of Verdict—Constitutional Law—Evidence.

1. In condemnation proceedings, an instruction as to the form of a verdict, leaving the amount to be allowed for compensation blank, but providing that "we, the jury, find no other property will be taken or damaged," is erroneous, where the evidence of defendant shows that it is entitled to damages for property not actually taken.

2. Local Improvement Act 1897, Sec. 23 (Starr & C. Ann. St. Supp. 1904, c. 24, par. 59), making the report of the commissioners in condemnation of a street prima facie evidence, being a mere rule of procedure, is not unconstitutional.

In condemnation proceedings by the city to extend a street across a railroad right of way, the city can show a way by user of less width than the street proposed, which fact is to be considered in connection with the evidence of defendant that the extension of the street across its railroad yards would render them less useful and greatly increase the cost of operation.—(Chicago Terminal Transfer R. Co. vs. City of Chicago, 75 Northeastern Reporter, 499.)

MASSACHUSETTS.—Municipal Corporations—Streets—Change of Grade—Damages to Abutting Owners—Street Railroads—Location—Change of Grade—Injuries to Abutting Owners—Same.

1. Where the grade of a street is altered by the grant of a location of a street railway, it is not altered "for the purpose of repairing such way," within Rev. Laws, c. 51, Sec. 15, providing that an abutter shall be entitled to compensation for damages sustained by the raising or lowering of a public way, or for the purpose of repairing such way.

2. Rev. Laws, c. 112, Sec. 44, making a street railway liable for injuries sustained during construction resulting from the carelessness of defendant's servants, if notice is given and an action begun as provided by chapter 51, Sec. 20, has no application to injuries suffered by an abutting owner by a slight raising of the grade of the surface of a street by the railroad company in the process of construction.

3. Where a street railway company was granted a location along a street, it was not liable for a slight raising of the grade from 6 to 15 inches, reasonably necessary as a matter of proper construction.—(Laroe vs. Northampton St. Ry. Co., 75 N. E. Reporter, 255.)

NEW YORK.—Carriers—Regulation—Transfers.

Railroad Law, Laws 1892, p. 1406, c. 676, Sec. 104, providing that railroad companies within the limits of incorporated cities and villages shall forfeit $50 to the aggrieved party for each failure to give a transfer entitling a passenger to a continuous trip to any portion of the railroad, does not require the giving of a transfer between two separate lines controlled by the same corporation, where they do not intersect, though one line approaches within 30 feet of the other.—(Ketcham vs. New York City Ry. Co., 95 N. Y. Supp., 553.)

NEW YORK.—Carriers—Transfer Tickets—Mutilation—Rejection by Carrier.

A street railway company may, pursuant to its rules, refuse a transfer ticket mutilated after coming into the possession of the passenger receiving it, but cannot refuse a ticket mutilated before given him.—(Koch vs. New York City Ry. Co., 95 N. Y. Supp., 559.)

PENNSYLVANIA.—Street Railroads—Use of Street Application to City—Second Application—Application of Second Company.

1. Act June 7, 1901, Sec. 1 (P. L. 514.), relating to street railroads, requires that the consent of the local authorities for the right to occupy the street shall be promptly applied for, and shall have been obtained within two years from the date of the charter. Held, that a delay after incorporation to apply for consent is immaterial, where it does not extend beyond two years.

2. Where a street railway company has applied, under Act June 7, 1901, Sec. 1 (P. L. 514), for permission to occupy the streets of a town, the fact that its first application is denied does not prevent a subsequent application within the two years granted by statute.

3. Where a street railway company has applied within the time granted by Act June 7, 1901, Sec. 1 (P. L. 514), for leave to occupy the street of the town, and has been twice refused, and a second street railway company has started its proceedings to extend its road within the two years, but when they were nearing their close, after the right of the first company has expired by the lapse of the two years, the second company is entitled to obtain the consent of the town.—(Nanticoke Suburban St. Ry. Co. vs. People's St. Ry. Co., of Nanticoke and Newport, 61 Atlantic Reporter, 997.)

PENNSYLVANIA.—Injunction—Laches—Acquiescence.

A street railway company secured the consent of a land owner to the location of its railway in a public road. The road was constructed, and afterwards the township sued to enjoin the railway from extending its switch in front of the property of the land owner. Thereafter the township waived its right to enforce the decree in its favor. Held, that the testamentary trustees of the consenting owner could not, eight years thereafter, and thirteen years after the consent was given, maintain a bill to compel the railway company to remove the switch.—(Taylor et al. vs. Erie City Pass. Ry. Co., 61 Atlantic Reporter, 992.)

PENNSYLVANIA.—Railroads—Motive Power—Electricity.

1. Where a railroad was incorporated under Act April 4, 1868 (P. L. 62), providing that every company incorporated under it shall be entitled to exercise all the rights and privileges given by Act April 19, 1849 (P. L. 79), it was not restricted to the use of steam as a motive power, but can use electricity; nothing being stated in the act about the kind of power to be used.

2. A railroad company, where it is not limited as to the power to be used, is required to use that which is best and most convenient for its operation, having due regard to the safety of the public.—(Howley vs. Central Valley Ry. Co., 62 Atlantic Reporter, 109.)

LIABILITY FOR NEGLIGENCE.

ALABAMA.—Street Railroads—Collision at Crossing—Personal Injuries—Complaint—Allegation of Negligence—Sufficiency—Trial—Evidence—Objections—Sufficiency—Appeal—Error in Refusing Instructions Cured by Instructions Given—Negligence—Question for Jury.

1. A complaint, in an action against a street railway company for injuries sustained by a mail clerk on a railway train in a collision with a street car at a crossing, which alleges that defendant was operating a street car line which crossed the tracks of the railway; that on the day of the accident the train collided with a street car at the crossing, and as a proximate consequence thereof plaintiff, who was on the train, was injured; and that the collision occurred and plaintiff received the injury by reason of defendant's negligence—is good, as against a demurrer averring that the allegations are indefinite and fail to show any negligence on defendant's part, and fail to show any duty owing by defendan to plaintiff.

2. Since a plaintiff, in an action for injuries received in a collision between a train and a street car, may testify to what he did at the time of the collision as a part of the res gestæ, a motion to exclude plaintiff's evidence relating to what he did at the time of the accident, together with his uncommunicated motives, is properly refused, for failing to single out the inadmissible evidence as to his motives.

3. Where, in an action for personal injuries, the only element of damages for loss of time proved was what plaintiff was earning, and the evidence showed that he was paid his wages while he was not working, the error in refusing to charge that plaintiff was not entitled to recover for the time lost was cured by a charge that he was not entitled to recover for lost wages.

4. Where, in an action against a street railroad company for injuries received by a person on a railway train by a collision with a street car, the evidence showed that a car of defendant was sufficiently near to the crossing of the railroad tracks to be run into by the train, the question whether the car was placed there through the negligence of defendant was for the jury, though it did not offer any evidence to negative the inference that the car was placed there by its servants.—(Birmingham Ry., Light & Power Co. vs. Livingston, 38 Southern Reporter, 374.)

ALABAMA.—Carriers—Passengers—Existence of Relation—Evidence—Who are Passengers—Questions for Jury—Injuries to Passengers—Negligence—Unusual Jerks.

1. On the issue of whether a small child, riding on a street car in company with his parent, but for whom no fare was paid, was a passenger, evidence of a general custom on the part of the street railway not to charge fare for the carriage of small children is competent.

2. A small child, riding on a street car in company with his mother, who pays a fare for herself, is a passenger, although no fare is paid for such child, where there is a general custom on the part of the street railway not to charge fare for the carriage of small children.

3. Testimony that "there were about seven or eight passengers on the car, and (plaintiff) was one of the passengers," raises a question for the jury on the issue of whether plaintiff was a passenger or not.

4. Evidence that a street car was stopped with unusual suddenness and a jerk, and that by the sudden stopping of the car plaintiff was thrown from his seat and injured, raises a question for the jury on the issue of negligence in the manner of stopping the car.—(Ball vs. Mobile Light & Ry. Co., 39 Southern Reporter, 584.)

ALABAMA.—Witness—Cross-Examination—Scope of Inquiry—Impeachment—Predicate for Proof of Inconsistent Statement—Appeal—Harmless Error—Ruling on Question to Witness—Carriers—Assault and Battery by Conductor—Instructions—Trial—Undue Prominence to Particular Evidence—New Trial—Papers Improperly Sent to Jury Room—Proceedings to Produce—Affidavits of Jurors—Grounds—Conduct of Counsel—Appeal—Questions of Fact—Decision on Motion for New Trial.

1. The scope of inquiry on cross-examination is limited only by the sound discretion of the court, with a view to test the memory, skill, accuracy, and judgment of the witness and the consistency of his answers with each other and with his present testimony.

2. A question propounded to a witness with reference to what he said to a third person was proper, where it laid the predicate for proof of a statement which, if made by the witness, was contradictory to his evidence.

3. Any error in allowing a question to be propounded to a witness as to contradictory statements made to a third person would be cured by the evidence of such third person, when called to prove the contradictory statement that no such statement was made.

4. In an action against a carrier for damages for assault and battery committed by its conductor upon a passenger, the court charged that, "even though it be the duty of the conductor to keep (plaintiff) out of that part of the car for white people, yet it was the duty of the conductor not to use any more force than was necessary for that purpose, and, if no force was necessary, then it was the duty of the conductor not to use any force to injure plaintiff." Held, that the giving of such charge was not reversible error, even if it be conceded that it is argumentative and abstract.

5. A requested instruction, giving undue prominence to the evidence of a witness named, is properly refused.

6. That the bill of exceptions which was reserved on a former trial of the case was inadvertently handed to the jury on their retirement was not ground for new trial, where the proof offered by defendant to support this ground of the motion did not show who handed the papers to the jury, and there was no claim that the possession by the jury of such bill was the result of misconduct on the part of anyone, and it was further shown that the bill was not read by the jury.

7. Where a motion for a new trial is asked on the ground that the bill of exceptions which was reserved on a former trial of the case was improperly sent to the jury room, affidavits of the jurors are admissible to show that the bill was not read in the jury room.

8. The persistence of counsel for plaintiff in their effort to prove the general reputation of plaintiff is not ground for a new trial, where no witness gave evidence of such reputation.

9. The Supreme Court will allow all reasonable presumptions of the correctness of the judgment denying a motion for a new trial, and will not reverse on the ground that the preponderance of the evidence is against the verdict, although the verdict for plaintiff is supported only by his own evidence and that of one other witness, while the defense is supported by the evidence of four witnesses.—(Birmingham Ry. & Electric Co., vs. Mason, 39 Southern Reporter, 590.)

CALIFORNIA.—Carriers—Injury to Passenger—Instructions.

1. In an action against a street railroad for injuries sustained by a passenger while alighting from a car, a charge that the burden is on plaintiff to show that the injury was caused by the act of defendant in operating the instrumentalities employed in its business, and that, if this be shown, there is a presumption of negligence, which throws upon defendant the burden of showing that the injury was sustained without negligence, was not subject to the objection of withdrawing from the jury the issue whether the car started while plaintiff was alighting therefrom, or whether he voluntarily left the car while it was in motion, or to any other objection, when considered with other instructions that a passenger who voluntarily alights from a moving car assumes the risks thereof, and cannot recover for injuries sustained, and that, if plaintiff alighted from the car while it was in motion, and was thereby injured, he was guilty of such negligence as to preclude a recovery.

2. Nor, in view of the above instructions, and the fact that the only issue was whether the car started while plaintiff was alighting therefrom, or whether he voluntarily left the car while it was in motion, was it error to refuse a charge that "in a case of this character the burden of proving negligence rests on plaintiff, and he must prove the negligence alleged in the complaint by a preponderance of evidence."—(French vs. Pacific Electric Ry. Co., 82 Pacific Reporter, 395.)

CALIFORNIA.—Carriers—Injuries to Passengers—Street Railroads—Instructions—Time to Alight—Premature Start—Negligence — Presumption — Trial — Issues — Instructions — Carriers—Injuries to Passengers—Actions—Instructions—Appeal—Review—Harmless Error.

1. An instruction, in an action for injuries to a passenger, that the carrier is required to exercise the highest degree of care in transportation of passengers, and that a showing that the injury was caused by the carrier's act in operating the instrumentalities employed in its business raises a presumption of negligence, which throws on the carrier the burden of showing that the injury was sustained without its negligence, was not erroneous, as requiring defendant to overcome plaintiff's showing by a preponderance of the evidence; the court having also charged that plaintiff was required to prove her case by a preponderance of the evidence.

2. Where a passenger alleged injuries by the premature starting of a street car as she was attempting to alight, the case was one in which the presumption of negligence arose from injuries resulting from the carrier's act in operating the instrumentalities used in its business.

3. Where the issues made by the pleadings were simple, were apparently not in dispute, and had probably been correctly stated to the jury by counsel, as provided by Code Civ. Proc. Sec. 607, the refusal of a requested instruction stating the issues to the jury was not error.

4. The court may properly refuse a request to charge fully covered by other instructions given.

5. Where, in an action for injuries to a passenger on a street car by an alleged premature start, the only negligence submitted to the jury related to the management of the car at the very moment of the accident, it was not error to refuse to charge that the carrier's failure to stop the car at the street where plaintiff intended to alight was not the proximate cause of her injury and did not entitle her to recover.

6. Where, in an action for injuries to a passenger, the court charged the proper measure of damages, and there was no evidence of any injuries other than those specifically alleged in the

complaint, defendant was not prejudiced by the refusal of an instruction limiting plaintiff's recovery to such specified injuries.—(Cody vs. Market St. Ry. Co. (S. F. 3489,) 82 Pacific Reporter, 666.)

CALIFORNIA.—Damages — Personal Injuries—Excessiveness — Trial—Expert Testimony—Cautionary Instructions—Reversible Error—Evidence—Presumptions—Failure to Call Witness.

1. In an action for injuries to a passenger, evidence held insufficient to show that a verdict for $2,000 was excessive, or that the jury were influenced by anything outside of the evidence.

2. In an action for injuries to a passenger, refusal to give a cautionary instruction as to the weight to be given expert medical evidence was not reversible error.

3. Where, in an action for injuries to a passenger, it appeared that she had been visited by four different physicians, one of whom, at least, was in defendant's employ, and two of them were merely called in consultation with the physician who had charge of the case, who was called as a witness, defendant having failed to call the others, it was not error for the court to refuse to charge that, where a party offers weaker or less satisfactory evidence, when it appears that stronger and more satisfactory evidence was within his power, the evidence offered should be viewed distrust.

4. Where the court charged that each item of damage claimed by plaintiff must be shown to a reasonable degree of certainty by a preponderance of the evidence, and that the law authorizes such reasonable damages as the jury deem plaintiff entitled to under the evidence, an instruction that in reaching a verdict the jury should not only consider all the evidence, but also all surrounding circumstances and draw all inferences from such circumstances and from the testimony as may be reasonably drawn, was objectionable, as authorizing the consideration of facts in addition to the evidence.—(Wood et ux. vs. Los Angeles Traction Co., 82 Pacific Reporter, 547.)

ILLINOIS.—Appeal—Review—Carriers—Injury to Passengers—Negligence—Contributory Negligence—Instructions—Trial—Instructions.

1. Where, on appeal to the Supreme Court from the Appellate Court, appellant obtains leave to file the briefs and arguments used in the Appellate Court, only those points urged in the Appellate Court will be reviewed, and not those made in a petition for rehearing in the Appellate Court; permission for leave to file having been denied.

2. Running an extra car so close to a preceding car that it could not be stopped on the slippery rails when the preceding car had stopped at a street crossing shows negligence in managing the car.

3. Where a car had stopped to allow passengers to get off at a crossing, that a passenger stood on the rear bumper of the car, not knowing that another car was approaching from the rear, is not negligence per se.

4. In an action to recover for injuries received in a rear-end collision between street cars, an instruction directing a verdict for defendant, if the collision was caused by the unavoidable slipping of the rear car on the wet rails, or if the usual means were taken to stop it, is properly refused for failing to consider the question as to whether the motorman attempted to stop the rear car in due time.

5. The refusal of instructions already covered by those given is not reversible error.—(Chicago City Railway Co. vs. Schmidt, 75 N. E. Reporter, 383.)

ILLINOIS.—Trial—Directing Verdict—Damages—Personal Injuries—Expenses—Evidence—Trial—Objections to Evidence—Evidence—Declarations Against Interest.

1. Where plaintiff's testimony as to the manner in which he was injured while attempting to board a street car is improbable, and defendant's evidence tends to show that he was injured on a different day, and in an entirely different manner, it is error to take the case from the jury.

2. A passenger, injured on a street car by the negligence of the railroad company, may recover all reasonable doctor's and surgeon's fees, and may show that a further surgical operation may be necessary.

3. Where, in an action for personal injuries, there is no evidence that a surgical operation has been performed or is necessary, evidence that a man in plaintiff's station of life would have to have $200 to be operated upon is incompetent.

4. Defendant objected to a question asked of a witness, and the court allowed the witness to answer after the question was put in a different form. Held in effect an overruling of the objection, and on defendant's exception the ruling is preserved for review.

5. In an action for personal injuries, evidence of statements of plaintiff made out of court to a doctor as to the cause of certain physical disorders prior to the accident in which the injuries were received, being in the nature of admissions against interest, was erroneously excluded.—(Chicago City Ry. Co. vs. Henry, 75 N. E. Reporter, 758.)

ILLINOIS.—Master and Servant—Injury to Servant—Defective Appliances—Fellow Servant—Vice Principal—Trial—Instructions.

1. A street railway company is liable for an injury to a servant because of the negligence of another servant in delivering a car without a motor handle, or with a handle which does not fit the car, and with which the car cannot be reversed.

2. If an injury to a servant is caused in part by the negligence of a fellow servant, yet the negligence of a vice principal contributed to the injury, the master is liable.

3. Where instructions given for defendant sufficiently cover an instruction asked by it and refused, the refusal is not cause for reversal.—(Chicago Union Traction Co. vs. Sawusch, 75 N. E. Reporter, 797.)

ILLINOIS.—Carrier's—Injury to Passenger—Presumptions—Burden of Proof.

1. There is no presumption of negligence on the part of a street car company, on proof that a passenger using due care was injured as the result of a collision between the car and a passing wagon.

2. In an action for injuries to a passenger on a street car by collision with a wagon, where the evidence is conflicting as to whether the car ran into the wagon or the wagon backed into the car, it is error to refuse an instruction that the burden of proof is on plaintiff to show by a preponderance of evidence that defendant was guilty of negligence.—(Chicago Union Traction Co. et al. vs. Mee, 75 N. E. Reporter, 800.)

ILLINOIS.—Carriers—Injuries to Passengers—Evidence—Rules of Carrier—Evidence—Opinions of Witnesses—Expert Testimony—Injuries to Passengers—Actions—Instructions.

1. In an action for injuries sustained by a passenger on a street car by being thrown to the ground by the sudden starting of a car as he was alighting therefrom, testimony of a common practice among passengers to get off cars at that place was competent.

2. In an action against a street railroad for injuries to a passenger sustained while alighting from the car during a stop at a railroad crossing, rules of defendant requiring cars to be stopped at a certain distance from railroad crossings, giving the motorman charge of the car while the conductor goes ahead to the crossing, and forbidding the motorman to start the car without seeing that no person is getting on or off, are admissible on the issue of defendant's negligence in starting the car.

3. In an action against a street railroad for injuries to a passenger caused by a sudden start of the car while he was alighting, a question asking witness whether it was physically possible for the motorman to see anybody getting off the rear platform in the nighttime was subject to the objection of calling for an opinion.

4. Testimony of a physician that in an examination of plaintiff he found "an apparent inability" to use the hip was properly allowed to stand, where witness subsequently stated that he could only form an opinion on the subject.

5. In an action against a street railroad for injuries to a passenger, where a rule of defendant relating to the conduct of employees at railway crossings was read in evidence, a charge that the rule was not admitted, and should not be considered as furnishing a substantive ground of complaint and base of recovery, was properly refused.—(Chicago City Ry. Co. vs. Lowitz, 75 N. E. Reporter, 755.)

ILLINOIS.—Carriers—Street Railways—Speed of Car—Contributory Negligence—Trial—Directing Verdict.

1. Where the seats, aisles, and platform of a street car are crowded, the railway company should so regulate the speed as to use the highest degree of care for the safety of passengers consistent with the practical operation of the car.

2. Whether it was negligence to board a car in its crowded condition, when urged by the conductor to "Crowd on! This is the last car for the city"—is a question of fact for the jury.

3. An instruction directing a verdict for defendant, if plaintiff had failed to prove certain allegations by a preponderance of the evidence, is properly refused, where a material allegation of negligence charged, and which the evidence tended to prove, has been omitted.—(Alton Light & Traction Co. vs. Oliver, 75 N. E. Reporter, 419.)

ILLINOIS.—Street Railroads—Collision with Wagon—Contributory Negligence—Trial Instructions.

1. In an action against a street railroad company for collision with plaintiff's wagon, whether plaintiff was in the exercise of due care held a question for the jury under the evidence.

2. Where a teamster deliberately drives on the tracks of a street car company, knowing that a car is approaching at a high rate of speed and must strike his wagon unless the car is stopped, and with intent to compel the car to stop, he is guilty of negligence per se.

3. Where an instruction given was identical in principle with one which was refused, the refusal was not error.—(Chicago Union Traction Co. vs. Jacobson, 75, N. E. Reporter, 508.)

ILLINOIS.—Negligence—Trial—Directing Verdict—Instructions—Street Railroads—Collision with Wagon—Care Required.

1. In an action for personal injuries, where the evidence is conflicting as to how the injury occurred, it is error to direct a verdict.

2. If an instruction is correct so far as it goes, and does not assume to point out all the elements necessary to a recovery, it may be supplemented by other instructions.

3. In an action for injuries caused by collision with defendant's street car, an instruction that a street railway company is chargeable with notice that the public may lawfully use the entire street, and that it must employ due care to avoid injury to persons using that part of the street occupied by its tracks, is not misleading in failing to charge that such persons must exercise due care for their own safety, where other instructions fully covered that phase of the case.—(West Chicago St. Ry. Co. vs. Schulz, 75 N. E. Reporter, 495.)

ILLINOIS.—Carriers—Diligence Required—Trial—Instructions—Evidence—Weight.

1. A street railway company must use all that care and vigilance for the protection of its passengers consistent with the practical operation of its road.

2. An instruction as to the care required of a carrier is erroneous which does not require it to be "consistent with the practical operation of the road."

3. An instruction that the testimony of one credible witness may be entitled to more weight than the testimony of many others, if the jury has reason to believe that such other witnesses were mistaken in their testimony, or knowingly testified untruthfully and are not corroborated, is erroneous.—(Tri-City Ry. Co. vs. Gould, 75 N. E. Reporter, 493.)

ILLINOIS.—Carriers—Collision—Injury to Passenger—Negligence—Tort of Third Person—Evidence—Damages—Pleading—Variance—Evidence—Opinion of Expert—Fright—Trial—Argument of Counsel—Taking Pleadings to Jury Room—Appeal—Estoppel to Allege Error.

1. In an action against a carrier for injuries to a passenger, evidence of collision between trains, without any contributory negligence on the part of the passenger, authorizes recovery.

2. Where the evidence showed that a passenger was injured by the failure of a railroad company to keep a main-track switch locked or guarded, so as to prevent it from being improperly thrown, whether this was actionable negligence is a question for the jury.

3. That a passenger was injured by the tort of a third person does not relieve the carrier from liability for its failure to use due care which gave an opportunity to such person to commit the act.

4. In an action for injuries to a passenger, where it is alleged that the train was running at a dangerous speed, the condition of the cars after the collision may be shown.

5. Proof that one of plaintiff's legs was broken and an elbow injured is no variance from an allegation that divers bones of her body were broken.

6. It is not proper to permit a medical expert to give an opinion based on the testimony as he has construed it from having heard it.

7. Where plaintiff claims that neurasthenia was brought about by injuries received in a collision, and defendant's witnesses testified that it might have been occasioned by other causes, plaintiff, on cross-examination, may show that it might have been caused by sudden fright and terror, where she was physically injured at the time of such fright.

8. Where, in an action for a collision caused by an unguarded switch, there was evidence that the switchman was watching a ball game, and the boy who threw the switch testified that it was not locked, an argument by plaintiff's counsel, based on the alleged negligence of the defendant, was proper.

9. It is not reversible error to allow the jury to take the pleadings to the jury room.

10. Any error in allowing the jury to take the declaration, containing counts to which demurrers had been sustained, to the jury room, is not ground for reversal, where appellant's counsel declined appellee's offer to remove the objectionable count.—(Elgin, A. & S. Traction Co. vs. Wilson, 75 N. E. Reporter, 436.)

ILLINOIS.—Carriers—Who are Passengers—Question for Jury—Appeal—Review—Affirmance.

1. In an action to recover for injuries, where there was testimony that when the car on which plaintiff was riding stopped he put one foot on the ground and with the other on the footboard attempted to lift his little girl off the car, when it started suddenly, injuring him, the question as to whether he was a passenger was for the jury.

2. Where the refusal of the trial court to direct a verdict was affirmed by the Appellate Court, its judgment will be sustained, if there is any evidence tending to establish the case made by the declaration.—(Chicago Union Traction Co. vs. Rosenthal, 75 N. E. Reporter, 578.)

INDIANA.—Evidence—Judicial Notice—Carriers—Ejection of Passenger—Excessive Damages.

1. A court will take judicial notice that a time between 4 and 6 o'clock in the afternoon of Sept. 16 was before sunset.

2. Where a passenger was required, without physical force, to leave a car in the afternoon before sunset, on account of a dispute as to the amount of her fare, the conductor explaining that his duty required him to act as he did, and she thereby missed an engagement with pupils in music, and was obliged to walk home, a distance of nine blocks, but she suffered no bodily injury or illness as a result of her ejection, an award of $400 as damages was excessive.—(Dayton & W. Traction Co. vs. Marshall (No. 5453), 75 N. E. Reporter, 824.)

KENTUCKY.—Street Railroads—Liability for Torts—Negligence—Instructions—Street Railroads—Questions for Jury—Right of Way Over Tracks.

1. In an action against a corporation and its successor for negligence in the operation of a street railroad, a verdict was properly directed in favor of the successor on its appearing that it was not in existence at the time of the accident.

2. In an action against a street railway company for injuries to a vehicle, an instruction authorizing recovery if the driver of the vehicle was "free" from negligence was improper, and was inconsistent with an instruction defining what contributory negligence would defeat recovery, as stating that any negligence, however slight, would defeat recovery.

3. Where the evidence was conflicting as to whether a collision between defendant's street car and plaintiff's vehicle was caused by the fault of the driver of the vehicle or of the motorman, the question was for the jury.

4. In an action for injury to plaintiff's vehicle from a collision with defendant's street car, it was error to instruct that the car had exclusive right to the track; but the court should have instructed "that the plaintiff was lawfully upon the street and had the right to use any part of it, that the defendant was entitled to the use of its tracks for the free passage of its cars, that it was the duty of those in charge of defendant's car to keep a lookout for persons and vehicles upon the track and to exercise ordinary care to discover and avoid injuring them, and that it was the duty of plaintiff in using the street to use ordinary care for his own safety and the safety of others."—(Palmer Transfer Co. vs. Paducah Ry. & Light Co. et al., 895 S. W. Reporter, 515.)

KENTUCKY.—Damages — Personal Injuries—Evidence — Sufficiency—Instructions—Proper Instruction — Negligence — Contributory Negligence—Instructions—Definition of Negligence.

1. Evidence in a personal injury case held sufficient to sustain the verdict, without attributing it to passion or prejudice.

2. An instruction that, if the jury find for plaintiff, they may, in estimating his damages, consider the physical pain and mental anguish caused by his injuries, if any, his loss of time, if any, his nervous and physical shock, if any, his loss of memory, if any, his impairment of eyesight, if any, his headaches, if any, and his permanent disability, if any, not to exceed the amount claimed, is erroneous and misleading in directing the jury, in estimating plaintiff's damages, to segregate such of his injuries as ought to be considered and estimated under the heads of physical and mental suffering and the permanent impairment of his ability to earn money, into special items of damage, and allowing them to estimate the damage for each item as distinguished from the others, and from the damages on account of physical and mental suffering or permanent disability.

3 A proper instruction on the measure of damages in a personal

injury case is that, if the jury find for plaintiff, they should allow him such a sum in damages as they believe from the evidence will fairly and reasonably compensate him for his physical and mental sufferings, if any of either, for his loss of time; if any, the reasonable expense, if any, in the matter of physicians' bills incurred by him, and for a permanent impairment, if any, of his ability to earn money, that may have directly resulted to him from his injuries, if they were caused by defendant's negligence, the damages altogether not to exceed the amount claimed in the petition.

4. It is error to instruct that plaintiff cannot recover if there was any negligence on his part, which in any way contributed to his injuries. His negligence, to defeat recovery, must have contributed to his injuries to such an extent that, but for it, he would not have received them.

5. In the absence of any evidence of contributory negligence, an instruction thereon should not be given.

6. In a negligence case, the court should give an instruction defining negligence and ordinary care as used in the instructions.—(South Covington & C. St. Ry. Co. vs. Nelson, 89 S. W. Reporter, 200.)

KENTUCKY.—Carriers—Collision—Injury to Passenger—Joint Liability—Damages—Personal Injuries—Instructions—Appeal—Failure to Request.

1. Where a collision occurs between the carriage of one common carrier and the car of another, both being negligent, injuring the passenger of one, both are liable; the negligence of one not excusing the other.

2. An instruction in a personal injury case that, if the jury find for plaintiff, they will fix his general damages at such sum as will reasonably and fairly compensate him for his bodily injuries, if any, not exceeding the sum claimed in the petition, and will also find special damages in such sum as will reasonably and fairly compensate him for his expense in getting cured, for his loss of time, and for injury to his clothes, if any, not exceeding the amount claimed, is substantially correct.

3. Where formal objection was made to all instructions given, and several instructions were offered as to certain matters, but none were offered or asked on the measure of damages, a party may not complain that such an instruction as he claims should have been given on that subject was not given.—(Louisville Ry. Co. et al. vs. Blum. Same vs. Goodman, 89 S. W. Reporter, 186.)

KENTUCKY.—Continuance—Surprise at Trial—Testimony of Witnesses—Evidence—Res Gestæ—Statements After Act Causing Injury to Another—Street Railroads—Injuries to Traveler—Instructions—Contributory Negligence.

1. On the trial of an action against a street railroad for injuries to a traveler in a collision with a car, plaintiff and witnesses testified that immediately after the accident the motorman came from the car to where plaintiff had fallen and stated that the reason he had not sounded his gong or stopped the car was because the gong and brake were out of repair. The motorman had left the service of the company and resided in another State, where his deposition was taken, without plaintiff asking any question on cross-examination indicating that he would rely on the testimony as to the motorman's alleged statement. The company's president filed an affidavit to the effect that it was surprised at plaintiff's evidence, and could show by the motorman that he did not make the statement testified to. Held, that the court, on the company's motion, should have discharged the jury and continued the case, to give it opportunity to rebut plaintiff's evidence.

2. The statement of the motorman of a car which had collided with a traveler that the reason he did not sound the gong or stop the car was because the gong and brake were out of repair, made immediately after the accident and before he had time to manufacture a false statement with regard to the cause of the accident, was a part of the res gestæ.

3. A street railway company, when sued for injuries received by a traveler in a collision with a car, is entitled to an instruction that, though it was negligent, yet, if the traveler was also negligent and his negligence contributed to the accident, so that but for it he would not have been injured, there can be no recovery.—(Lexington St. Ry. vs. Strader. Same vs. McKenna, 89 S. W. Reporter, 158.)

MAINE.—Street Railways—Personal Injuries—Child Injured on Track—Contributory Negligence—Due Care—Care Required of Infant.

1. In a case where a child 10 years and 7 months old, while attempting to cross an electric railway track in a street, was run over by a car, and where it appears that the car, at the time she attempted to cross, was in plain sight of her and could not have been much more than its own length from her, and where it is manifest either that she did not look to see if the car was approaching or that, if she looked, she must have seen the car, held, that her contributory negligence is a bar to her recovery against the railway company. Her act can hardly be regarded otherwise than a result of a sudden, unthinking impulse, or of reckless daring.

2. Though children are not by the law holden to the exercise of the same extent of care that adults are, and though the age and intelligence of a party are important factors in determining whether due care has been used, yet the plaintiff in this case was bound to use that degree or extent of care which ordinarily prudent children of her age and intelligence are accustomed to use under like circumstances.

Held, that the plaintiff clearly failed to use that care which a child of her intelligence should use.—(Colomb vs. Portland & B. St. Ry., 61 Atlantic Reporter, 898.)

MARYLAND.—Street Railroads—Right of Company and Individuals to Use Streets—Injury to Traveler—Contributory Negligence—Negligence of Company—Question for Jury—Necessity.

1. The rights of a street railway company and of an individual to use the streets are equal, and each owes to the other the same duty to avoid injury.

2. While a street railway company and an individual have an equal right to the use of a highway, an individual who, in disregard of his own safety, undertakes to cross the company's track when no prudent person would do so, cannot recover for the injuries sustained in a collision with a car.

3. It is not negligence as a matter of law for a traveler driving a four-horse wagon to attempt to cross a street car track when a car approaching is a block distant, but the question is for the jury.

4. Whether a street railway company was guilty of actionable negligence, and liable for injuries received in a collision by a traveler when attempting to cross the tracks, held, under the evidence, for the jury.

5. Where the nature of an act relied on to show negligence contributing to a personal injury can only be determined by considering all the circumstances, it is the province of the jury to pass on and characterize it.—(United Railways & Electric Co., of Baltimore, vs. Watkins, 62 Atlantic Reporter, 234.)

MASSACHUSETTS.—Street Railroads—Injury to Bicyclist—Contributory Negligence.

A person riding a bicycle at about noon in a crowded city street, who, when about to cross a street car track, looked to ascertain whether a car was coming, and, his view of an approaching car being obstructed, took his chances, and while crossing the track was struck by the car, was guilty of contributory negligence.—(Bartlett vs. Worcester Consol. St. Ry. Co., 75 N. E. Reporter, 706.)

MASSACHUSETTS.— Carriers — Passengers — Boarding Street Car—Contributory Negligence.

Plaintiff, intending to board an approaching street car, the side of which projected over the rail about 8 inches, stood in a space about 2 ft. from the south rail of the track at a stopping place, and as the car approached, plaintiff leaned his head forward and signaled the car, when he was struck on the head by some part of the car, but his body was not injured. Held, that plaintiff was guilty of contributory negligence in not taking a position outside the reach of the car, and was not entitled to recover.—(Neale vs. Springfield St. Ry. Co., 75 N. E. Reporter, 702.)

MASSACHUSETTS.—Carriers—Street Railroads—Injuries to Passengers—Rules—Negligence—Request to Charge—Negligence—Gross Negligence—Carriers—Degrees of Negligence.

1. Where plaintiff's intestate, while sitting in an open electric car, was thrown therefrom as it was being driven around a curve at a high rate of speed, and while a wooden rail intended for the protection of passengers, running along outside of the stanchions was up, and the company had provided by rule for a speed not exceeding 3 miles an hour on curves, the company was not guilty of negligence in failing to adopt a rule requiring the rail on the outer side of curves to be down when its cars are rounding such curves; the rails being intended only to prevent passengers from leaving the car on the inner side, where there are double tracks.

2. In an action for injuries to a passenger, a request to charge that the duty of exercising the highest degree of care is incumbent on the defendant, and any failure on the part of its servants to exercise that degree of care is "gross negligence," was properly refused, as a failure to exercise the highest degree of care constitutes slight negligence only.

3. A request to charge that the term "gross," in the term "gross

negligence," when used with reference to the degree of care required and not fulfilled, is merely an expletive, when the degree of care required is the very highest, was properly refused, since under such circumstances the term implies a gross failure to exercise that degree of care.

4. There are degrees of negligence in an action against a carrier for the death of a passenger, under Rev. Laws, c. 111, Sec. 267, providing that if a corporation operating a railroad, by reason of its negligence or by reason of the unfitness or gross negligence of its agents or servants while engaged in its business, causes the death of a passenger, etc., it shall be punished by a fine not less than $500 nor more than $5,000, which shall be paid to the executor or administrator, etc.—(Dolphin vs. Worcester Consol. St. Ry. Co., 75 N. E. Reporter, 635.)

MASSACHUSETTS.—Street Railroads—Injuries to Children—Negligence—Warning—Signal.

Plaintiff, a child less than 3 years old, in attempting to cross a street, darted from a sidewalk behind a wagon standing in front of plaintiff's home, and struck the running board of defendant's street car. The car was going at a moderate speed, and as it approached there was nothing in sight, and no children in the street for a distance of 200 yards. Held, that defendant was not guilty of negligence in failing to sound the gong on the car as it approached the place of the accident.—(Bouthillier vs. Old Colony St. Ry. Co., 75 N. E. Reporter, 960.)

MICHIGAN.—Electricity—Injuries — Inspection—Reasonableness —Evidence—Judicial Notice—Electricity—Care Required—Instructions—Prejudice—Time for Repairs—Question for Jury—Proximate Cause—Evidence—Expert Testimony—Competency of Witness — Demonstrative Evidence — Appeal — Review — Harmless Error — Electricity — Personal Injuries — Actions—Evidence.

1. In an action for injuries caused by a live electric wire, the reasonableness of the inspection depends, not only on the condition of the line, but also on the nature of the danger to be feared.

2. Judicial notice will be taken of the fact that electricity is dangerous and so generally recognized.

3. In an action for injuries caused by a live electric wire, an instruction requiring of defendant the exercise of such care as ordinarily careful and prudent persons would exercise in dealing with electricity under similar circumstances was not prejudicial to it.

4. Plaintiff's child was injured by coming in contact with a live telephone wire, which received its dangerous current from a trolley span wire belonging to defendant, through being pressed against the span wire by the limb of a tree, which was broken by a storm the previous evening at a considerable distance from the point where the wire parted and fell and where plaintiff was injured. There was evidence that the span wires were not properly insulated and were not protected from impact with other wires. Held, that whether defendant was guilty of negligence in these respects was for the jury, notwithstanding the short time that elapsed between the breaking of the wire and the accident in which to discover and make repairs.

5. Where plaintiff was injured by coming in contact with a live telephone wire, which had been pressed down against an improperly insulated trolley span wire by the limb of a tree, which was broken by a severe storm the previous evening, the failure to guard the span wire and the want of insulation were concurring causes establishing a liability, and the breaking of the tree was not the sole proximate cause of the injury.

6. In an action for injuries caused by a live electric wire, witnesses who were experienced in the use of certain alleged defective insulators used were entitled to testify as to their experience in their use, and to give their opinion as to their effectiveness, as well as their tendency to fall into disuse in places where formerly used.

7. In an action for injuries caused by a live electric wire, it was proper to introduce an insulator or hanger in evidence which was alleged to be defective and insufficient.

8. In an action for injuries by a live electric wire, defendant was not prejudiced by a question, asked of its foreman on cross-examination, as to whether it was not common knowledge among defendant's employees that defendant's span wires were charged, where it did not appear that the witness admitted such fact.

9. In an action for injuries by a live electric wire, which had become hot by contact with defendant's trolley span wire, it was proper to ask defendant's foreman on cross-examination whether he had not warned lineman against hot span wires.—(Warren vs. City Electric Ry. Co. et al., 104 N. W. Rep., 613.)

MISSOURI.—Appeal — Harmless Error — Variance — Carriers—Measure of Carrier's Duty—Continuance of Relation—Alighting from Street Car—Duty of Conductor—Instructions—Damages—Personal Injuries—Future Suffering.

1. Where, in an action against a street railroad company for injuries to a passenger, plaintiff alleged that while she was dismounting, and before she had sufficient time to do so safely, the car was negligently started with a sudden jerk and at a rapid rate of speed. Held, that the allegations as to the manner of starting the car were not essential to the cause of action, so that failure to prove them was not cause for reversal, under Rev. St. 1899, secs. 655, 798, providing that no variance shall be deemed material, unless it has actually misled the adverse party, and that, where the cause of action is unproved in its entire scope and meaning, it shall not be deemed a case of variance, but a failure of proof.

2. Street railways are common carriers, and must employ the highest degree of care to avoid injury to their passengers.

3. The relation of carrier and passenger continues until the time the latter leaves the train, so that it is the duty of the carrier, not only to safely carry the passenger, but, when his destination is reached, to keep the train stationary while he is alighting.

4. A street car conductor is required, in the exercise of due care, to look to see if passengers are in the act of alighting before he starts his car, though the car has been stationary for a reasonable length of time to permit passengers to alight.

5. In an action against a street railway company for injuries alleged to have been caused by the sudden starting of the car as plaintiff was dismounting therefrom, an instruction predicating plaintiff's right to recover upon proof that, while the car was standing, plaintiff took a position upon the back platform for the purpose of stepping off, and that, while in that position and before she had sufficient time to get off, the defendant's servants suddenly caused the car to be started, did not, when considered with another instruction forbidding a recovery if plaintiff stepped from the car after it started, authorize a finding for plaintiff, notwithstanding the jury might believe that she did not attempt to step from the car until after it had started.

6. In an action for personal injuries, plaintiff may recover damages for pain which will be suffered in the future as a result of the injury.—(Nelson vs. Metropolitan St. Ry. Co., 88 S. W. Rep., 1119.)

NEW JERSEY.—Street Railroads—Injury of Child at Crossing—Negligence of Motorman.

A motorman operating a street car on approaching a crossing where a number of children are congregated or passing across the tracks is bound to know that they may not exercise the care of older persons, and to take special precautions accordingly to avoid their injury; and where in such case a child was run over and injured, and there was evidence of a substantial character tending to show that the car approached the crossing at a speed of 10 m.p.h. or 15 m.p.h., without giving any warning of its approach, although such evidence was contradicted, a verdict finding that the company was chargeable with negligence will not be disturbed.—(Camden Interstate Ry. Co. vs. Broom, 139 Fed. Rep., 595.)

NEW YORK.—Trial—Directing Verdict—Conflicting Testimony.

Where, in an action for injury to a passenger in a street car, from the sudden stopping of it by the motorman on the blowing out of the motor box, plaintiff's testimony tends to show the explosion was due to a short-circuit, caused by rapid motion of the car through the water, which was high enough on the street from a recent rainfall to splash up on the sides, in which case, if the motorman was careless in running at too high a speed, the company would be liable for his negligence, though the sudden stopping of the car might not alone have been more than an error of judgment, and defendant's testimony tended to show the explosion was due to lightning, in which the company would not be liable for the mere error of judgment of the motorman in making a sudden stop, the trial court, disbelieving plaintiff's testimony, may grant a new trial, on verdict being rendered for plaintiff; but it may not direct a verdict for defendant.—(Dowling vs. Brooklyn Heights R. Co., 95 N. Y. Sup., 105.)

PENNSYLVANIA. — Street Railroads — Collision — Evidence — Negligence—Evidence.

1. In an action against a street railway company to recover for injuries received by collision between a wagon in which plaintiffs were riding and an electric car, evidence held insufficient to show negligence on the part of defendant.

2. In an action against a street railway company for injuries received by a collision between an electric car and the wagon in which plaintiffs were riding while crossing a bridge, where the accident was shown to be caused by a defect in the bridge, plaintiffs, to recover, must show that defendant, and not the town, was re-

sponsible for the repairs of the bridge.—(Wagner et al. vs. Lehigh Traction Co., 61 Atl. Rep., 814.)

NEW YORK.—Appeal—Contentions Available—Questions Not Urged Below—Carriers—Injuries to Passengers—Negligence—Questions for Jury—Discretion of Trial Court—Setting Aside Verdict—New Trial.

1. Where plaintiff declined to join in defendant's motion for a directed verdict, and expressly requested to go to the jury, he could not contend on appeal that the case should have been disposed of as one of law.

2. In an action against a street railroad for injuries to a passenger, sustained by being kicked in the face by another passenger who was entering the car through the window, where there was evidence that at the station where the accident occurred people had frequently gained ingress to cars during rush hours by climbing through the windows, without the railroad having taken any measure to prevent the practice, but defendant's employees testified that they had never heard of an accident from that cause previous to the injury to plaintiff, the questions whether the practice was so common that defendant knew or should have known of it, and, if so, whether it should have foreseen the likelihood of injury to passengers, were for the jury.

3. Appellate courts exercise great caution in interfering with orders of trial courts setting aside verdicts as against the weight of the evidence.

4. Where a question involving inferences from undisputed evidence is submitted to the jury, and the inference adopted by the jury is fairly warranted by the evidence, the fact that the trial justice thinks that the jury drew the wrong inference does not warevidence.—(Grogan vs. Brooklyn Heights R. Co., 95 N. Y. Sup., 23.)

SOUTH CAROLINA.—Street Railroads—Injuries to Person on Track — Intoxication — Instructions — Trial — Examination of Witness—Exclusion of Witness—Necessity of Exceptions—Appeal—Instructions—Harmless Error—Trial—Instructions—Exceptions—Street Railroad—Care Required.

1. In an action for injuries to plaintiff by being struck by a street car, where defendant pleaded contributory negligence, in that plaintiff went on defendant's right of way, defendent may show, by questions to plaintiff and by his declarations, that he was intoxicated at the time of the accident.

2. In actions for injuries to plaintiff on street car track, under the plea of a general denial, defendant may show plaintiff's intoxication, as tending to show contributory negligence, and to impair his credibility.

3. An instruction, in an action for injuries to a person on a street car track, that voluntary intoxication will not excuse a traveler for failure to exercise ordinary care at a railroad crossing, is properly refused as inapplicable to the case.

4. Where a witness testified that he did not write a letter, nor procure anyone to write it for him, it cannot be read to him, in order to ask him if he did not write it.

5. Where witnesses have been excluded by order of the court, it is discretionary with the trial judge to allow a witness who has been in the court room a part of the time to be examined on matters not testified to by the other witnesses.

6. It is incumbent on one desiring to base exceptions on error of judge in stating issues raised by the pleadings to call the court's attention to it.

7. An instruction charging a proposition of law inapplicable to the facts is not ground for reversal. where the jury could not have been misled thereby.

8. Where the court charges a proper request, but commits error in remarks in connection therewith, an exception to such remarks must be taken to procure consideration on appeal.

9. The motoneer on an electric car must keep an ordinary lookout for persons on the track.—(Sharpton vs. Augusta & A. Ry. Co., 51 S. E. Rep., 553.)

TEXAS.—Carriers—Injuries to Passengers—Negligence—Excessive Speed—Contributory Negligence—Alighting from Moving Car—Damages—Medical Expenses—Interference with Duties—Pleading.

1. In an action against a street railroad for injuries to a passenger, where defendant pleaded contributory negligence in attempting to alight from a car while in motion, and the evidence raised the issue, a requested charge that, if the passenger attempted to alight from the car while in motion, and before it had stopped for passengers to alight therefrom, and a person of ordinary care would not have so acted under similar circumstances, the verdict should be for defendant, should have been given, although the court had given a general charge on contributory negligence.

2. In an action against a street railroad for injuries to a passenger, a charge on the speed of the car as in violation of a city ordinance should not have been given where the ordinance was not introduced in evidence.

3. The running of cars in a city at a speed greater than that allowed by ordinance is negligence per se, and the court may so instruct, if the ordinance is in evidence, whenever it is proper to charge on the rate of speed.

4. In order that a street railroad may be held responsible for injuries to a passenger on the ground that it was running its cars at a greater speed than allowed by a city ordinance, the speed must have caused or contributed to cause the accident.

5. In an action for injuries, a petition alleging that the person injured was seriously and permanently injured in her head, hips, limbs and ankles should have also stated the nature and character of the injuries to such parts, and if, for any reason, such nature and character could not be stated, the petition should so allege.

6. In an action for injuries there could be no recovery for expenses for a drug account, domestic help, and attendance of nurses, in the absence of evidence that those expenses were reasonable, and rendered necessary by the accident.

7. In an action for injuries, a charge to allow such reasonable expenses as plaintiff was compelled to incur for medical attention was erroneous where the evidence showed the amount and reasonableness of the bill of one physician, and also showed services by other physicians, the amount or reasonable value of whose services was not shown.

8. A minister cannot recover damages for hindrance in ministerial duties and loss of time from study and preparation for his work, resulting from an injury to his wife, where no pecuniary loss is shown, but he may recover the value of time necessarily lost in attendance upon his wife.—(Dallas Consol. Electric St. Ry. Co., vs. Ison, 84 S. W. Rep., 408.)

TEXAS.—Carriers—Injuries to Passengers—Negligence—Construction of Cars—Contributory Negligence—Vicarious Negligence.

1. Whether a street railroad was negligent in using, for the transportation of small children, an open car, the seats of which projected beyond the floor, so as to leave an opening or pitfall through which a child might fall to the street, is a question of fact.

2. A finding that a street railway was negligent in using for the carriage of a small child an open car, the seats of which projected along the floor, so as to leave an opening or pitfall through which the child fell to the street, was justified.

3. Contributory negligence of parents who carry their child on a street car of defective construction is not imputable to the child, in such manner as to preclude him from recovering from the street railway for personal injuries occasioned through its negligence.—(Northern Texas Traction Co. vs. Roye, 86 S. W. Rep., 621.)

WASHINGTON.—Appeal—Stare Decisis—Application of Doctrine—Death—Actions—Beneficiaries—Surviving Husband—Actions—Misjoinder of Causes of Action—Refusal to Amend—Effect.

1. Ballinger's Ann. Codes and St. Section 4828, provides that "the widow, or widow and her children, or child or children if no widow," of a man killed in a duel shall have a right of action against the person killing him, etc., and further provides that, "'when the death of a person is caused by the wrongful act or neglect of another, his heirs or personal representatives" may maintain an action for damages. The Supreme Court, in construing the word "heirs" so as not to include "parents," did so upon the theory that it was limited in its scope to the persons therefore specifically mentioned in the statute. Held, that the decision was conclusive under the rule of stare decisis against the right of a surviving husband to maintain an action for the death of his wife.

2. Ballinger's Ann. Codes and St. Section 4828, relative to the right of action for wrongful death, gives the surviving husband no right of action for the death of his wife.

3. The husband's right of action for funeral expenses paid by him on the wrongful death of his wife cannot be joined with an action on behalf of the minor child of the husband and wife for the death of his mother.

4. Where a cause of action in favor of a minor son for the death of his mother was improperly joined with a cause of action by the son's father for funeral expenses incurred on account of such death, and a demurrer to the complaint was sustained on that ground, but with leave to amend so that the son might state his cause of action separately, a judgment for defendant was properly rendered on the son's declining to amend.—(Johnson et al. vs Seattle Electric Co., 81 Pac. Rep., 705.)

LONDON LETTER

(*From Our Regular Correspondent.*)

At the invitation of the Romapac Tramway Construction Company, Ltd., of Leeds, a party of journalists were given a practical demonstration of this company's system of laying down its compound rails for tramway purposes. The company has hitherto preserved a complete silence regarding the system, as it desired to be able to point to certain portions of tramway work equipped with its system before having it described in the technical press and before appealing to any of the municipalities or companies operating tramways for a share of their patronage. The system is described in full in another part of this issue, but it might be described briefly as composed of a permanent T-rail, to which is fastened another section of rail which forms the head of the rail. The demonstration consisted in showing the engine which is designed for this purpose, and which successfully rolled down the top section of a rail about 40 ft. long on to the company's standard T section in a very few minutes. The process is the invention of Mr. Rhodes, and seems to be a very successful one. Seven or eight passes up and down the rail were quite sufficient to bend the flanges by means of the powerful side rollers attached to the steam engine in such a way that the top section became firmly attached to the T section. For such a system to be complete, it is necessary also to be able to cut off the top section when it becomes worn out, and the journalists were also shown a practical demonstration of how easily this is accomplished. The same machine was used, but in place of the rollers for rolling down the flanges of the top section, cutting wheels were inserted, and after a few passes up and down the rail the flange was completely cut off. Then, by means of a special device, the top section was easily lifted off. The whole demonstration was a practical success, and it would appear that this system is bound to receive in the near future the attention which it merits from tramway engineers, as it will undoubtedly save a considerable portion of the expense of new rails.

The Hastings Tramways Company has not been able to overcome the prejudice of the Hastings Corporation against the overhead wiring system on the sea front, and has offered to equip the front on the G. B. surface contact system, of which a full description as installed at Lincoln was given in the last international issue of this paper. The Corporation has not yet had time to give the matter proper consideration, but it is thought that it will probably be only too glad to accept the proposition.

The members of the London County Council have evidently had a most enjoyable trip to Paris, where for about a week recently they were entertained by the Paris municipality and saw everything that was worth seeing in that metropolis. Since returning, J. Allen Baker, chairman of the tramways committee of the London County Council, said that one of the greatest object lessons which he had observed in Paris, so far as tramway work was concerned, was the fact that tramways were carried across nearly all the bridges of the Seine. As is, of course, well known, there are no tramways across any of the bridges of the Thames in London, and repeated endeavors of the London County Council to secure a bill in Parliament for this purpose have been defeated. He also stated that the decision of the London County Council to use the conduit system instead of the overhead system was amply justified by the experience of Paris. He also stated that the tramway companies were compelled to pay a small tax on each fare toward the maintenance of the streets.

It is interesting to note how many references to electricity appear in the half-yearly reports of the various steam railroad companies. The North Eastern Railway reports states that further experience in electric traction of the suburban lines in the Newcastle district has been entirely favorable from a practical and from a financial point of view. Lord Allerton, speaking at the half-yearly meeting of the Great Northern Railway Company, stated that that company was feeling to a considerable degree the competition of the tramways, particularly in Yorkshire, but that its suburban traffic in London had been maintained. Six new railway motor cars have been added to the rolling stock during the past half year, and in the Lincolnshire district these are working very successfully, the Board of Trade having given them permission to erect rough platforms at convenient points and to pick up passengers without fixing any particular time. With regard to the London, Brighton & South Coast Railway, Lord Cottesloe made the interesting statement that the directors were now so impressed with the fact that they had chosen the right system in the single-phase system, that they now intended to equip the suburban line right into the two main stations of Victoria and London Bridge. It will be remembered that the company's first idea was to equip a portion which commenced some distance away from each of these two termini. Reference has already been made to the contracts given out for this installation, and it would appear that after further investigation, the directors are thoroughly satisfied that they are moving in the direction of progress. Sir George Armytage, at the half-yearly meeting of the Lancashire & Yorkshire Railway, which, as is well known, has installed the electric railway between Liverpool and Southport, stated that a full year's experience had shown that the cost of working the trains, with proper allowance for depreciation and the more costly plant, were slightly higher per train-mile run than the steam trains. They were, however, quite satisfied, as they had been able to do a greater amount of work and had given a better service to the public, which would have been absolutely impossible under the old conditions. He also stated that they were now contemplating further additions, as the traffic was rapidly growing, and during the past year a very largely increased number of passengers had been carried by the electric trains. He made the entirely satisfactory statement also that the whole system was working smoothly and well.

The city of Blackburn for the past year or two has been rather disturbed about its tramway system, as when the proper amounts were allocated to interest on the investment, depreciation, etc., the whole system showed a distinct loss. It is more satisfactory, therefore, that during the nine months ended Dec. 31 last, after paying interest, allowing for depreciation, maintenance, etc., there remains a substantial profit of over £1,000. We do not often refer to the financial statement of the various systems in this column, but we do so in this particular case, as the result is not attributable to any great increase in the number of passengers carried, but to economies which have been effected by reducing the mileage of suburban lines, and also very largely to the offer which the municipality made in the shape of a bonus to the motormen for saving electric current.

Oxford has at last decided absolutely and unmistakably against electric trams. The university town will have none of them. We referred some time ago to this particular case, electric tramways having been advocated by one section, while another section was strongly in favor of motor omnibuses. A plebiscite of the ratepayers recently taken shows 5092 against electric tramways, whereas there are only 1117 in favor of them. It is not likely that motor omnibuses will be permitted, as they would pay no portion of the maintenance of the streets, so that it would appear that Oxford for at least some time has decided to get along as best it can with the old antiquated horse tramway system which it has at present.

The London County Council has opened its new route from Westminster to the Obelisk at Lewisham. The cars run via Walworth Road, Peckham and New Cross to the Marquis of Granby, where the new lines diverge, running along the Lewisham High Road to the Obelisk, where they will shortly be continued to Catford Bridge.

The London County Council electric supply bill passed the preliminary stage in the House of Commons. In this bill the London County Council has applied for authority to supply electricity in bulk for power and traction, not only in London, but throughout a wide area beyond the administrative county. No opposition was raised to the bill in the preliminary stage, and as the standing orders have been complied with, the bill was ordered to be reported for first reading.

The London United Tramway Company has opened up a new section of its extensive system of tramways which has been in course of construction for the past year in the vicinity of Kingston. The completion of these lines forms an important link in the tramway system in the west end of London, as it will enable passengers to travel along both sides of the Thames Valley and will bring all of the towns in this vicinity into direct communication with each other.

The Bath Electric Tramways Company has put motor omnibuses on the roads as feeders to its trams. Three services have been started, to Bradford-on-Avon and Trowbridge (9 miles), to Corsham and Chippenham (11 miles), and to Box and Melksham (9 miles). The next services to be started will be from Coombe Down to Frome (11 miles), and up Lansdown, a hill which has hitherto baffled every form of mechanical traction. The vehicles used are 30-horse Milnes-Daimlers, double-decked.

The Folkestone Town Council has sanctioned the bill which is being promoted by the National Electric Construction Company for powers to make lines connecting Folkestone with Cheriton, Sandgate and Hythe. Residents and frontagers are raising a fund to oppose the bill, but efforts are being made to meet their objections. The Dolter stud system is proposed, but the promoters agree to a clause providing that the system shall be in working elsewhere in the United Kingdom for six months before it is adopted at Folkestone. It is being installed at Torquay and Mexborough at present, and as both systems are nearly completed, this condition should not be a difficult one to fulfill.

The Croydon Council has finally refused the offer by the British Electric Traction Company for the purchase of the tramways which belong to the corporation and have been leased to the company. The Corporation having given notice to terminate the lease, the company submitted fresh offers, which were rejected. It then offered to buy the whole undertaking and pay over one-half of the net profits, with the right of repurchase in twenty-five years. The Council rejected the offer, as well as fresh proposals for re-leasing the system. The present lease of the company expires on June 1 next, and this decision of the Corporation practically means that the city will work the trams.

Considerable progress has been made with the tramways at Torquay. The whole of the special work in connection with the two triangular lay-outs on the Strand has been practically completed, and it is now intended to continue the excavation of the track along Victoria Parade to Beacon Quay, which will be the terminus in this direction. The linking-up of the track in front of the Town Hall is in progress, and as soon as this is finished the final linking-up of the track at Market Street corner will be proceeded with. When this is done, the whole of the route from Torre Railway Station to Beacon Quay will be complete. The second track is being laid along Upton Road in the direction of St. Mary-Church, and the rails have been carried to a point within a few yards of the junction of Studley and Forest Roads. A site has been definitely fixed upon in Forest Road for the car sheds, and it is expected that building operations will soon be in progress. As is well known, the National Electric Construction Company is doing the work, and is laying down the Dolter system of surface contact.

Another important extension of the electric tramways system of the Middlesex County Council, from the Wood Green terminus to Enfield, has been opened for public service. The section, which will be some 4 miles in extent, will traverse the whole length of the historic Green Lanes, passing through the populous districts of Bowes Park and Palmer's Green. With its completion the rapidly growing center of Bush Hill Park will be brought into closer touch with the city and Alexandra Palace.

The Bristol Tramways Company has extended its excellent car service into the country by means of motor buses from the end of the tramway lines from Brislington to Saltford, from Hanham to Kelston, and from Horfield to Thornbury, and the patronage extended to the new system shows how much it is appreciated by the public.

In the Chancery Division last week, Justice Farwell delivered judgment in an important action brought by Messrs. Sutton & Company, carriers, for a declaration that the Corporation of Manchester was not entitled "to carry, collect, or deliver for reward any goods or parcels otherwise than by their tramways, and that it was unlawful for them to expend any part of the city fund or the receipts of the tramway undertaking for any such purpose." His Lordship held that the Corporation had no statutory power to carry goods apart from its tramway system, and that while as a chartered corporation it had such power it was not entitled to expend any part of the funds referred to for the purpose of establishing, maintaining, or carrying on the business of carriers except as part of and in connection with its tramway undertaking. An injunction was granted against the Corporation in these terms, its operation being suspended for fourteen days. The intention of the Manchester Corporation was to put into operation a large and comprehensive scheme of parcel collection and delivery, including an express delivery and railway agency service outside the bounds of the tramway area. Several thousand pounds have been spent on depots, horses and vans, and numerous agents and servants have been engaged. A. C. S.

PARIS LETTER

(*From Our Regular Correspondent.*)

It is reported here that the Ouest Railway Company is now about to commence the electrification of its Paris-St. Germain line. The scheme has been proposed several times, but it seems that it will at last be taken in hand. The line is now operated by steam locomotives, which do not easily handle the large traffic, and reaches St. Germain on a steep grade. On this account the trains have to be divided to permit the locomotive to mount the grade. The length of the line is some 12 miles, and the tracks to be equipped with third rail are the middle two tracks out of six which will soon be constructed for a short distance out of Paris. There are now four tracks.

The Paris Metropolitan Railway maintains its traffic receipts well over those of a year ago, since which time no new lines have been opened. It is curious to remark that the receipts of the Paris General Omnibus Company, which operates various omnibus and tramway routes within Paris, have also considerably increased over corresponding figures of 1905. The new circular line (south) of the Paris Metropolitan Railway, which will be opened for service on March 1, will encroach considerably upon the receipts of the Tramway Sud, which have hitherto been constantly increasing month by month.

The third rail of the Paris Metropolitan line has been considerably modified in the new lines about to be placed in service. The new steel conductor contains but a small percentage of carbon and is of exceedingly low resistance. Its form is that of a "T," of which the head or horizontal branch is broad and thick and the vertical part is short. The rail rests on rectangular blocks of porcelain or vitrified clay, which are grooved to hold the vertical part of the rail. The horizontal part of the rail rests on the top of the insulator. The rail is relatively light for the amount of surface exposed to the contact of the shoes.

There has been a deal of discussion here of late regarding bad workmanship in connection with the construction of tunnels and superstructure of the new lines of the Paris Metropolitan Railway. This work is carried out by the municipal authorities' subcontractors, and when completed the railway company takes over the operation of the lines. Several well-known names have been brought into prominence in the daily press in connection with the matter, which at one time threatened to amount to a scandal.

Monsieur Gauthier, the French minister of public works, has been studying the question of transport on branch lines of steam railways, including lines of local interest, in view of complaints which are continually made regarding the slowness of transport on such lines, owing to the few number of passengers and tendency to make up mixed trains for the carriage of both passengers and goods. M. Gauthier has very strongly advised the employment of motor cars on these secondary lines, to be, of course, run at more frequent intervals and to supplant the more cumbrous trains now in use. In view of the high standing of the minister in such matters a move is sure to be made towards extending the use of this form of transport, which is even now in use on several of the main railway systems of France.

Public opinion has been moved of late regarding the means of access to the Simplon tunnel from the various French centers of population. The matter has been left too long and there are a number of opinions to be taken and details to settle. The contract for the electrical equipment of this line contains a clause for the eventual equipment of the line with single-phase apparatus, and three-phase was adopted temporarily, only because the material could be delivered promptly and in time for the opening in June.

It cannot be said that municipalization is making any striking progress in France in respect to matters of public transport, notwithstanding the examples set by our near neighbors in this respect. The towns which wish to obtain electric traction are not averse to obtaining the concession, but they are rather keen in making a bargain with a contracting company for the equipment of the lines and operation. This is the case recently with the town of Valenciennes, which has made application for a concession for a tramway system for the town, with the avowed intention of later turning the same over to a contracting company, probably to be chosen by public tender. It is true that the town leases the concession for a certain term of years, and unless the leases are then extended the material falls into the hands of the town. As the leases range about sixty years in length it will be many years before the municipal question is an acute one in France.

The Compagnie Générale de Distribution d'Energie Electrique recently increased its capital from six to twelve millions of francs, with the object of constructing an electrical power station in the environs of Paris of a capacity of 70,000 kw, part of which will be immediately installed for the purpose of supplying current to the Nogentais tramways and the Tramway Sud, two of the principal Paris tramway systems. It is expected that the station will supply the needs of several other traction companies in and around Paris. The work on the new station will be pushed with the greatest speed, and it is expected to be in operation in eighteen months or less. Curtis steam turbine groups will probably be installed.

FRANCHISES IN NEW JERSEY

The special commission appointed by the Governor of New Jersey to investigate the subject of franchises granted by municipalities to public utility corporations, and to advise the Legislature in connection therewith, has just rendered its report. The commission was a very representative one, and consisted of Foster M. Voorhees, Franklin Murphy, Frank T. Lloyd, John C. Payne and Eckard P. Budd.

The commission reviews the relative advantages of the three principal methods of conducting public utility services, viz.: private ownership and operation, municipal ownership and operation and municipal ownership and private operation, and after describing the methods of making grants in other States express themselves as opposed to municipal operation. Their recommendations follow:

RECOMMENDATIONS

"As a result of their consideration and investigation of the matters to them referred, the commissioners would make the following recommendations, briefly stating their reasons for so doing:

"(1.) They would advise against municipal operation of street railways. The practical difficulties in the way of both municipal ownership and management of street railways, aside from considerations of public policy, are such that the commissioners cannot recommend a system which involves both ownership and management, with all that it implies and involves. So far as street railways are concerned, municipal ownership of tracks is a comparatively simple matter. Terms could easily be made whereby tracks could be used by companies which operated either in one municipality exclusively or in more than one political division. But it would not be such a simple matter in cases of municipal operation. In this State, one of the companies controlling street railways operates in twenty-five different municipalities. Complete municipalization would present many difficult problems. A conflict in system would undoubtedly arise. The local feeling of one political division would prevent or make difficult the extension of the system of another within its borders. The problem is being worked out with more or less success in Great Britain and Germany. It has not been free from mistakes, and, consequently, expense and loss to the public. But we do not think it wise to recommend and experiment with new plans not yet thoroughly tested until the experience of others has shown that the system in vogue, with some possible modifications, is inferior. It should be remembered that all that goes to make for the development of new territory, for improvement of apparatus, scientifical and mechanical, for comparatively low rates of fare for distance carried, for cheapness of commodities and service furnished, our own method of service to the public, under the system of grants now in vogue, faulty though it may be, in many respects surpasses that of other countries.

"The commissioners venture to say, notwithstanding assertions to the contrary, that there has been found in no community the ideal condition of affairs, so far as relates to management of its public utilities, no matter what the system adopted. Perfect satisfaction exists nowhere, and probably never will be found. In all fairness it should be said that many of the defects of service, resulting from private management of these corporations, are such as can be reasonably attributed in large measure to the demands for the development of new and unprofitable fields, the carriage for longer distances, and at more frequent intervals, the extension and cheapening of service, and the replacement of old with new equipment, and the consequent increased expense. Such inconveniences as the public experience from defective and unsatisfactory service cannot be wholly attributed, or even chiefly, to the method which it has followed in its grants to these companies, nor do we believe that a perfect service would come with municipalization.

"(2.) The present power to make grants and give consents should remain where it is. The Legislature has in all cases left to each locality the determination of this matter, adhering to the principle of local self-government, and believing that in the long run and in the great majority of cases, the local authorities are unquestionably better judges of the requirements of those dwelling in a given locality than outside tribunals. This practice should not be lightly disregarded or hastily abandoned except for reasons which commend themselves to all right thinking and careful-minded people. Without controlling reasons, there should be no radical departure from this well settled and long established policy. Neither should new limitations be prescribed, except such as will equally apply to all communities. Local authorities should not be unduly hampered in the use of powers long possessed. The power to make such contracts as particular conditions and the attendant circumstances in each individual case may warrant, should be left with the municipalities. They are the best judges of what may be required under such circumstances.

"(3.) All privileges hereafter given should be limited, and not exceed thirty-three years, unless a majority vote of the legal voters should authorize longer grants, not to exceed sixty-six years. Recent experience, not only in our own State, but in many others, has shown that the rapid growth of population and improvement in motive power and equipment, improved and cheaper facilities of production and the attendant increase of public patronage, has been followed by returns beyond the expectation of those who first applied for, and those who granted the privileges. This return to new companies will, in most cases, if we are to judge from the experience of the past, so increase as the years pass that it will be folly to permit parting with new privileges in perpetuity. Adjustment of terms, from time to time, to make them accord with changed conditions should be made obligatory. The power to adjust may be lost unless the grant be limited. In grants so restricted there will be found a chance to exact new terms in place of those which had been unduly liberal or hastily considered. Such seems to be the consensus of best opinion, as evidenced by recent legislation in other States and countries. In exceptional cases, where the limitation to thirty-three years might prevent capital from embarking in enterprises of doubtful or slow return, it will be perfectly safe to permit the people themselves, within some prescribed limit, to extend the length of time; hence, the recommendation for a submission to popular vote. In fixing the time for the limitation of grants by municipalities, the commissioners recognize that the determination is purely an arbitrary one, and is subject to honest differences of opinion. The length of a generation is commonly accepted as thirty-three years. In principle, each generation should, so far as possible, have the opportunity to express its wishes in matters peculiarly affecting its welfare; hence, the recommendation that this number of years should mark the length of the franchise. The limitation is recommended for grants by the constituted authorities. Extensions beyond that time can be granted only by a vote of the people themselves.

"(4.) At the expiration of any grant the municipalities should have power to again fix the period and terms of further grant, not exceeding thirty-three years, and the company whose franchise expires should have the first privilege to accept the same. In default of such acceptance the municipality should be authorized to grant the same to another company upon its making proper compensation for the fair value of the assets of the refusing company. Capital will not embark in new ventures unless opportunity be given it to secure a return for its risks. So well is the field in the State now occupied by grants already given that for years to come more than the mere right to possess and enjoy a franchise for a limited term must be given if the interests of the public are to be served and facilities offered to localities sparsely settled. Everyone knows that in early years the outlay is large and the return small. In order to properly develop a franchise in such localities, the earning must of necessity be invested in the improvement or extension of the plant. This is especially true of water and gas companies. Unless there be an assurance that the opportunity for reimbursement will come, there will be no inducement to capital to venture in places where it is most needed. A term franchise, strictly limited, may be accepted in thickly settled communities, but these are already largely occupied. In new localities and unoccupied fields, such a limtation would serve only as a bar against the investment of capital.

"(5.) The restriction limiting the construction of railroads within 1000 ft. of another railway in the same street and preventing the building of a new road parallel to an existing line within less than two blocks should be repealed. This prohibition, if continued in force, can only operate to create a monopoly in favor of existing companies, especially favored by liberal grants, and franchises in effect perpetual. If not removed, it will serve to check the construction or development of new lines which will afford increased public accommodations. Viewed in the light of present demands, the existing facilities for travel may be regarded as sufficient. But that rapid growth which all signs seem to indicate may be reasonably expected in urban population, at least in certain parts of the State, will surely make necessary the building of new roads and extension of old, if the accommodations are to keep pace with the needs of the public. Every obstacle in the way of extension and the building of new should be at once removed.

"(6.) The practice that has prevailed of an excessive issue of stock and bonds under guise of law should be rendered impossible in the future. This should apply to all issues hereafter made. They who hazard their investment in enterprises, the success of which is not assured or to which it may come only after the lapse of years and large expenditures of money, may rightly claim a higher reward for their faith and their courage than those whose investments are attended with no risks of loss and are immediately profitable. But the franchise—granted upon easy terms—should not afford to the few adventurous ones the means and the opportunity to suddenly amass excessive wealth by withholding from the public, by whom the grant is made, its share or allowing it one which only serves to shock the sense of fairness. Massachusetts for some years has provided against excessive issues of bonds and stock by forbidding their issue until approved by some board appointed for that purpose. Some such approving authority should be created in this State. The appointment would be in the interest of the investing public as well as the non-investing. The practice in the State mentioned has not thwarted enterprise. We find therein an efficient public service which has increased from time to time so as to meet public needs and which has well met all reasonable requirements. The courts of our State have recently and in no uncertain way expressed their opinion as to the validity of 'watered' stock and excessive bond issues. But by the adoption of the recommendation that all issues of securities shall first be approved by some supervisory authority, all doubts as to the validity and necessity of issues will disappear, and the additional advantage of safety of investment be gained."

Recommendations Nos. 7 and 8 refer to gas and water companies. Recommendation No. 9 is that there should be no change in the present method of imposing a franchise tax or fee, which is 2 per cent of the gross receipts. In referring to this tax, the commissioners say that they prefer to understand and consider it as a license fee for exercising a privilege granted by the State rather than a tax on some species of property owned by the companies. They also do not consider themselves as limiting the fee to the present amount, but that a gradually increasing rate, graduated according to the average annual mileage receipts, could be imposed in some cases.

AFFAIRS IN CHICAGO

W. W. Gurley, general counsel of the Union Traction Company, called on Mayor Dunne, last week, in company with Ex-Corporation Counsel Tolman, representing the River Improvement Association, and talked for 2 hours over a possible solution of the tunnel problem. What the Union Traction Company wants to do is not only to blow the tops off the tunnels so the order of the War Department will be complied with, but to rebuild them at the required depth so they can be used for street car purposes. General Manager Roach has told his company it will be physically impossible to move the street car traffic of the North and West Sides over the bridges alone. At the same time the company wants the right to equip with the trolley its cable lines throughout, claiming it would be impossible to change its motive power at the rivers without hopelessly blocking its cars during the rush hours. This is the thing the Mayor thus far has refused to concede. The other interesting development of the week was Secretary Taft's presence in town. He said his plan of action regarding the lowering of the tunnels, as set forth in his letter to Congressman Mann a year ago, has not changed, although he did not care to go further in the discussion. "The tunnels must be lowered," he said. "It is my duty to see that they are lowered. The date set as the limit of grace to be allowed the city I believe was April 15, 1906, decided upon by my predecessor, Mr. Root. I have not been approached by anybody representing the city of Chicago with a view to securing more time, and I can't say what I should do until the matter comes before me in my official capacity." The plan which Mr. Gurley proposed to the Mayor was:

Bulkheads to be built at the ends of the tunnels and then the tops knocked off so as to comply with the order of the Federal Government that the obstructions be out of the way by April 15.

At the close of navigation in the fall the tunnels to be reconstructed for street car travel, so as to give 26 ft. of water over their tops. The Union Traction Company agrees to pay the cost of this if given the use of the tunnels after reconstruction.

In order to bring its cars downtown during the reconstruction period the company to be given the right to substitute trolleys for cables wherever cables now exist, not only in the business district but on the North and West Sides.

THE LIMIT AS REGARDS SUITS

B. B. Davis, secretary-treasurer of the American Association of Street Railway Claim Agents, has sent to the STREET RAILWAY JOURNAL the appended newspaper item taken from among the clippings received daily by the Columbus Railway & Light Company, which is self explanatory.

LOUISVILLE, KY., February 12, 1906.

Mrs. Josephine King told an unusual story in Judge O'Doherty's court to-day, in the trial of her $5,000 damage case against the Louisville Railway Company, which was decided against her. Mrs. King asked judgment on the representation that she pursued her daughter, Lillian King, to prevent her getting on a street car to meet the conductor, W. T. Wiley.

"My girl got on the car all right, but it was because her skirt ripped," said Mrs. King. gazing steadily at the jurors. "Bill Wiley telephoned Lill from the car barn to meet him on his run, and when she asked me if she might, I just stamped my foot and said 'No, sir.' Well, directly I sees Lill gliding out of the house. When she hit the street she ran fast. I took after her. It was a race, I tell you, 'tween me and that car. I could see it comin'. I knew it was Bill Wiley's too. Just as my girl was about to get on I grabbed her. Then her skirt ripped and Bill pulled the bell, and everybody laughed. I broke my leg eight years ago. When I ran after Lill I wrenched my leg, and besides my feelings were hurt. I think the company ought to pay me."

The jury was only out a few minutes considering a verdict.

REPORT OF NASHVILLE RAILWAY & LIGHT COMPANY

At the annual meeting of the stockholders of the Nashville Railway & Light Company, held in Nashville a few days ago, the following directors were elected: Percy Warner, J. H. Fall, F. O. Watts, Joseph H. Thompson, A. M. Shook, of Nashville, and A. H. Ford, J. K. Newman, S. H. March and George H. Davis, of New York. Immediately after the adjournment of the stockholders' meeting the directors met and elected the following officers: Percy Warner, president and general manager; J. H. Fall, vice-president, and N. P. Yeatman, secretary and treasurer. The report of President Warner on the business of the past year was received and read. The matter of extensions, improvements and betterments was left to President Warner and the directors. Secretary and Treasurer N. P. Yeatman made the following report to the directors and stockholders, which was considered the most satisfactory statement yet made by the company. The report is a comparative statement of the operations in 1904 and 1905, and is as follows:

	1904	1905
Earnings railway department	$750,410.25	$832,742.02
Earnings light department	248,561.16	324,907.73
Total gross earnings	$998,771.41	$1,157,649.75
Operating expenses railway department	420,175.60	453,819.52
Operating expenses light department	121,871.53	136,772.37
Total operating expenses	$542,047.13	$590,591.89
Net earnings	$456,924.28	$567,057.86
Income from other sources, rent, advertisements, etc.	11,109.66	16,727.13
Gross income, less operating expenses	$468,033.97	$583,784.99
Deductions from income—		
Interest on funded debt	264,008.00	291,045.45
Interest on current liabilities	3,225.15	7,696.09
Taxes, real, personal and privilege	91,704.22	99,969.83
Bond premium	5,138.75	12,048.23
Reserve and emergency fund	....	13,500.00
Total deductions from income	$364,076.10	$424,259.60
Surplus	$103,957.87	$159,525.39

The Senate cities committee of the New York Legislature, on Tuesday, Feb. 20, reported out the Elsberg Rapid Transit Bill. This provides for the separation of construction and operation contracts for future subways in New York. It will probably be discussed by the Senate during the present week.

SECOND QUARTERLY MEETING OF THE NEW YORK STATE ASSOCIATION

President Danforth, of the Street Railway Association of the State of New York, has called a special meeting of the association, to be held at Elmira, N. Y., on March 29, to discuss transportation matters. The success of the quarterly meeting, held at Schenectady last January, was so pronounced that the executive committee has decided to make these quarterly meetings a regular feature of the association's work.

At the Elmira conference the entire day will be devoted to the reading of papers and discussion on topics pertaining to operation and management. The following subjects have been assigned:

"Interchangeable Mileage Books."
"Collection and Registration of Interurban Fares."
"City Schedules."
"Advertising."
"Methods of Discipline."
"Station Rules."

The invitation is extended to all member companies and non-member companies in New York State and electric railway companies outside of the State to have a responsible representative from their operating departments at the Elmira conference.

THE IOWA CONVENTION PROCEEDINGS

L. D. Mathes, of Dubuque, Ia., has just issued the proceedings of the second annual convention of the Iowa Street & Interurban Railway Association, held at Dubuque, Ia., April 20 and 21, 1905. The proceedings are neatly bound in board cover and contain the papers and discussions at the Dubuque meeting as well as a copy of the constitution and by-laws. The next convention will be held at the Kirkwood Hotel, Des Moines, Ia., on April 19 and 20, 1906. Applications for copies of the proceedings should be made to Secretary Mathes.

THE ROCHESTER & ELMIRA ELECTRIC RAILWAY—HEINZ & COMPANY INTERESTED

After the sale by the Heinz interests of their holdings in the Montana copper fields, the announcement was made that one of their first deals in financing, under the firm name of Otto Heinz & Company, would be to arrange for the building of the Rochester & Elmira Electric Railway Company, projected between Rochester and Elmira, N. Y. The new company will be capitalized at $4,000,000, divided into 40,000 shares. Franchises have already been procured in all the townships through which the road will run, and for a goodly part of its length private right of way across country has been contracted for. No construction or grading has been attempted, but surveys have been made of the entire route. The enterprise is in such shape that work may be started as soon as the formal approval of the State Railroad Commissioners has been obtained. The route runs through Brighton, Avon, Livonia, Lakeville, Dansville, Cohocton, Bath, Painted Post, Corning and Horseheads to Elmira, paralleling the Erie tracks from Corning westward. The line will be single-track, and as surveyed will be 120 miles long. The incorporators are Max H. Schultze, Horace G. Abel, Stanley Gifford, Henry Brunssen, Frederick Eckstein, Henry Velthusen, C. B. Geer, Tracy S. Buckingham and Ralph Wolf.

APPLEYARD SYSTEM SOLD TO WIDENER-ELKINS—PLANS FOR EXTENDING OPERATIONS

Last week all of the Appleyard properties in Ohio passed into the control of the so-called Widener-Elkins syndicate. The purchase gives the syndicate unbroken lines from Zanesville, Ohio, to Cincinnati. Except for the Dayton & Western, the Dayton & Troy and the Western Ohio lines, the syndicate now controls all of the through lines between the most important centers of Ohio and Michigan, in all about 1800 miles. The properties will be transferred by Theodore Stebbins, "general manager for the receivers," to Theodore Stebbins, "general manager for W. K. Schoepf, agent."

On Feb. 19, A. E. Loche, acting for the Philadelphia syndicate, bought in the Dayton, Springfield & Urbana Railway for $600,000. The bonded indebtedness of the road is $750,000 and the floating debt about $65,000. On Feb. 20 Mr. Loche bought in the Columbus, London & Springfield Railway on a bid of $250,000. This property has a bonded indebtedness of $1,500,000 and floating debt of about $100,000. On Feb. 21 the same interests bought in the Central Market Street Railway of Columbus for $150,000. Besides the purchase price, the buyers assumed a liability of $500,000. The Columbus, Grove City & Southwestern sold the same day to the same interests for $35,000. This property has debts of $208,000. The Urbana, Bellefontaine & Northern property was sold Feb. 24 for $175,000. In this case a bonded indebtedness of $500,000 was assumed. The lease on the Springfield & Western Railway, a 10-mile line, was acquired with the Dayton, Springfield & Urbana. The entire system includes about 170 miles of road, for which the syndicate paid $1,210,000 and assumed debts to the amount of probably $3,826,000. The indications are that the stockholders of these properties will have but little equity after the floating debts and expenses of receivership have been paid.

It is stated that the syndicate will take steps immediately to extend the Urbana, Bellefontaine & Northern from Bellefontaine to Lima. This would give the syndicate through routes from Columbus to Lima and Toledo, and from Cincinnati to Lima and Toledo without making it necessary to make arrangements with the Dayton & Troy and the Western Ohio lines, which thus far it has been unable to acquire. W. Kelsey Schoepf, the active head of the syndicate, denies that the Columbus Railway & Light Company's property is to be acquired. He has also denied that the syndicate is attempting to acquire the Columbus, Delaware & Marion property.

RECONSTRUCTION OF GEARY STREET RAILWAY IN SAN FRANCISCO

At a meeting of the Supervisors of San Francisco, Feb. 19, the new plans for the Geary Street, Park & Ocean Railway were filed by City Engineer Woodward, and after they had been approved a resolution calling for the bids for the reconstruction of the line was passed by the board and signed by the Mayor. The date when such bids are to be opened has yet to be set.

The plans submitted are in lieu of plans and specifications presented Dec. 4, 1905, and subsequently withdrawn. The cost of the work is estimated at $328,000.

In submitting the plan City Engineer Woodward said: "I desire to state that they have been prepared in accordance with instructions of the former Board of Supervisors, and provide for the use of the old rails and old roadbed, which, in my opinion, should not have been done. As municipal ownership is about to be given a trial in San Francisco, it should begin under the best auspices, and the entire road should have been newly constructed. The present roadbed will not long stand the heavy cars which will be used, and when it becomes necessary to properly rebuild the road, the blame should rest where it belongs, and not upon the present administration.

"The condition of the crossings at Jones Street and at Larkin Street is such that I have felt it absolutely necessary to build them anew as part of the present work.

"Your attention is called to the fact that all the other crossings along the line of the road will require reconstruction in the near future. Provision should also be made for the removal of the old tracks which are not utilized in the new road, including the turntable at Kearney Street, the Y at Grant Avenue, the curves at the First Avenue car house and the curve at Fifth Avenue. It is also very necessary that provision be made for the repair of the pavement on the roadway between the tracks and on either side thereof for the entire length of the reconstructed road, and for the construction of a new pavement between the tracks of the proposed new roadbed.

"As to the site of the car house, I wish to say that the Baker Street lot was bought against my protest. It is within the range of early probability that the new municipal railroad will have a branch road on Broderick Street, and I recommended, as did also former City Engineer Grunsky, that the lot on the corner of Geary Street and Broderick Street be purchased."

The route of the proposed line is as follows: From the west line of Kearney Street, out Geary Street turning into Point Lobos Avenue at Presidio Avenue, out Point Lobos Avenue to Fifth Avenue, past the present turn of the present line to the park, on to Tenth Avenue, and to Fulton Street at Golden Gate Park.

THE PLANS OF THE PUBLIC SERVICE CORPORATION

On Saturday, Feb. 24, President Thomas N. McCarter, formally admitted that plans are making for strengthening the finances of the Public Service Corporation. He is stated to have said that the details will all be divulged at the annual meeting of the company to be held April 2. From the statements made in unofficial sources it would seem that the plan is somewhat different from that first mentioned a few weeks ago, to which reference was made in the STREET RAILWAY JOURNAL. Then it was stated that J. P. Morgan & Company and the Pennsylvania Railroad were both to be admitted to ownership in the company through the issuance of additional securities. Now it is stated the negotiations contemplate the purchase by J. P. Morgan & Company of $8,300,000 of the new $12,500,000 stock which the Public Service Corporation arranged to issue at the next annual meeting and the acquisition by the United Gas Improvement Company, which holds one-fourth of the stock now outstanding, of a sufficient amount to give that corporation $8,300,000 of the total issue of $25,000,000. This would leave the Prudential-Fidelity interest, or the Newark investors, with $8,400,000 of the total. Mr. McCarter has flatly denied the story to the effect that he is to resign from the company.

LOS ANGELES-PACIFIC IMPROVEMENTS

President E. P. Clark, of the Los Angeles Pacific Railroad, emphatically denies the persistent rumor that E. H. Harriman or the Southern Pacific Railroad Company has secured control of the Los Angeles Pacific Company, through the purchase of the interest of the Clark-Sherman syndicate. In talking about affairs of the Los Angeles Pacific Company to a representative of the STREET RAILWAY JOURNAL, Mr. Clark said the company has just about completed the floating of its issue of $10,000,000 of bonds for the purpose of standardizing and re-equipping its system, and that in anticipation of this work, contracts have been let for new rails and accessories. The work of rehabilitation, so Mr. Clark says, will be carried on as fast as compatible with thorough workmanship.

ATTEMPT TO RAISE FARES IN MASSACHUSETTS

The difficulties encountered in raising fares has recently been illustrated in the case of the Boston & Northern Street Railway Company. This company formerly charged 10 cents between Melrose and Boston, but some time ago a 5-cent fare was tried as an experiment. It was soon found to be insufficient to meet the reasonable expenses of operation, and the company raised its fare to 7½ cents by selling ten tickets for 75 cents. The public, after considerable protest, lodged a complaint with the Railroad Commissioners, before whom the question is now for adjudication. Melrose is a suburb with 14,000 inhabitants, about 7 miles from Boston, with which it is also connected by the Boston & Maine (steam) Railroad. The fare on the steam railroad is 14 cents, with a commutation rate of 9 cents a trip. One of the complaints made against the Boston & Northern Railroad is that the commutation tickets are not sold by the conductors but must be purchased at one of the offices of the company. This is also true, however, of the steam railroad, and under all the circumstances it is difficult to believe that there are any good grounds for complaint.

TERMS OF ACQUISITION OF PHILADELPHIA COMPANY

Official announcement is made of the plan by which the United Railways Investment Company of San Francisco will acquire control of the Philadelphia Company, of Pittsburg. The plan does not contemplate the purchase, at present at least, of the entire capital stock of the Philadelphia Company, but only of 320,000 shares of the common stock, which represents a controlling interest. According to the official statement, the United Railways Investment Company will exchange $37.50 (face value) in first lien collateral trust twenty-year 5 per cent sinking fund bonds and $20 (par value) of investment company common stock for each share (par value of $50) of the Philadelphia Company common stock, included in the 320,000 shares to be purchased. Under arrangements with Ladenburg, Thalmann & Company a syndicate has been formed to acquire from any depositing Philadelphia Company stockholder the common stock of the investment company, so payable to such depositor at a sum equal to $95 a share, so that each depositing Philadelphia Company common shareholder may receive, if he prefers, for each share of Philadelphia stock $37.50 in 5 per cent bonds and $19 cash.

A TALE OF MISGUIDED ENTHUSIASM

Upon application of George W. Wormuth, the Superior Court of Indiana has appointed Joseph T. Elliott, Jr., receiver of the Interurban Publishing Company, of Indianapolis. This company was organized by E. H. Talbott, W. D. Herd, George W. Wormuth and others for the purpose of publishing the "Interurban Railway Journal"—a publication devoted to the interests of interurban electric railroads. The company issued $10,000 capital stock, and plaintiff Wormuth alleged that he had not been allotted an equal share of the stock and lack of harmony among the stockhalders, and also that the company was insolvent. The evidence showed that the company had commenced publication Nov. 25, 1905, and issued ten numbers of the journal. It then suspended because there were no funds to pay the cost of printing and salaries. E. H. Talbot, who was editor of the paper, was formerly editor of the "Railway Age," of Chicago.

IMPROVING THE PITTSBURG, KAN., SYSTEM

The extension of the electric railway line of the Pittsburg Railway & Light Company is now practically completed to Weir City, 10 miles southwest of Pittsburg and 6½ miles beyond Chicopee, the former terminus of the line. A further extension south from Weir City to Columbus, 13 miles distant, is now being built. When completed the line will pass through Chicopee, Klondike, Fleming, Daisy Hill, Weir City, Scammon, Skidmore, Tuerk and Stippville, all of which are mining towns, varying greatly in size. The road is being constructed for high-speed service, the maximum grade being 1½ per cent. A power house, to contain one 300-kw d. c. generator is being erected at Scammon. Three of the cars to be used on this line have already been received, and six more are now being constructed. The cars are finished in mahogany, and will seat forty people, and are driven by two G. E. No. 80 motors.

ANNUAL REPORT OF THE INTERNATIONAL TRACTION COMPANY

The International Traction Railway Company, of Buffalo (including International Traction Company, International Railway Company and Crosstown Street Railway Company) has issued its report for the year ended Dec. 31, 1905. It is as follows:

	1905	1904
Gross	$4,484,643	$4,088,426
Expenses	2,483,663	2,412,769
Net	$2,000,980	$1,675,657
Other income	68,562	64,515
Total income	$2,069,542	$1,740,172
Interest, taxes, rent, etc.	1,652,376	1,606,052
Surplus	$417,166	$134,120
Expended on extensions and betterments	345,310	....
Net surplus	$71,856	....

President Pierce, of the company, in his remarks to the stockholders, says that within the last year the company has made long-time contracts for the purchase of power for the Tonawanda-Lockport-Olcott district. Besides, agreements have been made with several suburban roads by which their cars will be brought into the center of Buffalo over the lines of the company.

The entire capital stock of the Electric City Railway Company, of Niagara Falls, N. Y., has been purchased at a cost of $108,500. This company owns valuable franchises and has 4 miles of track constructed.

All of the equipment of the International Traction Company is in use, and 150 new cars, to cost $900,000, have been ordered.

President Pierce further says: "In the great and rapidly growing section of country covered by our city and suburban lines many extensions and betterments are being constantly required, and as the terms of our collateral trust mortgage make it impossible to borrow money by issuing additional bonds we shall be obliged during the next two years, at least, to expend the net earnings of the company in order to maintain our position, and, in addition, we may have to create some floating indebtedness. While it is to be regretted that we shall be unable to pay dividends for the present, yet your directors feel that they are best protecting and furthering the interests of the stockholders."

STREET RAILWAY PATENTS

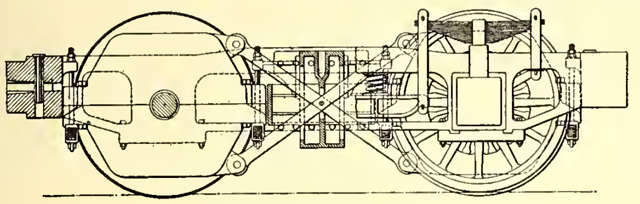
[This department is conducted by Rosenbaum & Stockbridge, patent attorneys, 140 Nassau Street, New York.]

UNITED STATES PATENTS ISSEUD FEB. 20, 1906

812,873. Ice Cutter for Surface Railways; Wm. H. Perry, Concord, N. H. App. filed Oct., 1905. A vertically adjusted drum mounted in advance of the car and provided with cutters, said drum being rotated through suitable gearing from the motor propelling the vehicle.

812,825. Railway Switch-Operating Apparatus; Clyde J. Coleman, Rockaway, N. J. App. filed Feb. 4, 1905. The switch is thrown by a piston in a cylinder containing an expansive fluid. The cylinder also contains a heat coil to heat and expand the fluid by means of an electric current.

812,851. Trolley for Electric Cars; John H. Kinter, Indiana, Pa. App. filed Aug. 5, 1904. Mounted at one side of the trolley harp and fixed to rotate above the wheel in a horizontal plane is spider-shaped member for retaining the wheel against the conductor. The spider rotates to permit the passage of hangers, etc.



PATENT NO. 812,891

812,881. Hanger or Ear for Overhead Electric Trolley Wires; Abraham Richardson, Blackpool, Eng. App. filed Feb. 6, 1905. The hanger consists of two halves, which together clamp and hold the trolley wire. The screw for supporting the hanger has a surrounding ferrule which serves to clamp the two halves of the hanger together.

812,891. Interconnected Suspension Means for Gearless Motors; Robert Siegfried, Pittsburg, Pa. App. filed June 12, 1905. A pair of electric motors and supporting connections between the motors and the truck, and a pair of balancing-links, each of which connects the upper side of one motor with the lower side of the other.

812,900. Rail-Bond; Edward G. Thomas, Cambridge, Mass. App. filed Dec. 24, 1902. A bond designed to be located beneath the fish-plates and comprises a bundle of copper ribbons with a clamping plate at each end, arranged to be screwed to the rail.

812,991. Railroad Tie; Samuel N. Griffith, Chicago, Ill. App. filed May 14, 1904. Comprises a metallic trough and a pair of metal-bound blocks seated in the trough and adapted to receive the spikes employed in securing the rails in place, each block and its metal binding being removable as a unit from the balance of the structure.

813,052. Electric Brake for Vehicles; Joseph N. Mahoney, Astoria, N. Y. App. filed Nov. 8, 1901. An electric braking system comprising opposed braking surfaces and means for controlling the pressure between them by two currents, one of which varies relatively to the speed of the car, and the other of which is appropriately controlled, whereby the pressure between the braking surface is varied in relation to the speed of the vehicle.

813,091. Tramway Switch; Otto C. N. Gundersen, Spokane, Wash. App. filed July 12, 1905. A pair of sector gears in the roadbed which, when depressed, move the switch, one to the right and the other to the left, through suitable gearing.

813,101. Closed Conduit for Electric Railways; Augustus W. Lohman, Sr., Chattanooga, Tenn., and Johan Pruis, Chicago, Ill. App. filed March 22, 1905. A conduit system in which the grip-slot is normally closed by spring shutters. The shutters have wedge faces, so as to be displaced during the passage of the collector shoe. A sectional conductor is also provided, which is temporarily energized during the passage of the car.

813,154. Automatic Switch for Electric Railways; Victor Joksch, Karlin-Prague, and Josef Petrick, Prague, Austria-Hungary. App. filed May 26, 1905. The tongue of the railway switch is controlled by a solenoid with two coils, and the current can be sent to one or the other of said two coils by changing the position of a small switch-lever in the car itself, said lever being arranged in a secondary current.

813,249. Convertible Car; Frank B. Stanley and John L. Gillmore, Bellingham, Wash. App. filed Aug. 12, 1905. Side seats are arranged in sections, and an operating lever extending lengthwise of the car swings the seats across the car for summer use.

813,267. Reversible Car Seat; Hubert Witte, St. Louis, Mo. App. filed July 7, 1905. Details of a "walk-over" car seat.

813,295. Adjustable Track or Trolley Wire; Willie Hills, Kansas City, Kan. App. filed May 6, 1905. Consists of two wires, one arranged vertically above the other, and means for adjusting both vertically and laterally.

813,346. Adjustable Brake Hanger; George M. Brill, Philadelphia, Pa. App. filed May 1, 1905. Consists of a rod having a ball at each end resting in adjustable sockets, which in turn rest in casings, one of which is attached to the brake beam and the other to the car truck.

813,389. Process for the Prevention and Laying of Dust in Roads, etc.; William M. Sandison, Ashfield, Ayton, Scotland. App. filed Feb. 28, 1905. Consists in the application to the surface of roads or pavement dressing of an aqueous emulsion obtained by combining wool-fat with an alkali or alkaline salt.

PERSONAL MENTION

MR. THOMAS WHITING has resigned as claim adjuster of the Old Colony Street Railway Company, of Boston.

MR. J. P. ALEXANDER, who was formerly with the Westinghouse Companies' Publishing Department, has just been appointed assistant purchasing agent of the Wheeling Traction Company, of Wheeling, W. Va.

MR. E. R. MASON, vice-president of Porter & Berg, is now recovering from an operation performed on him several weeks ago for appendicitis. Mr. Mason was taken to the Lakeside Hospital very suddenly, under the advice of his physician, to be operated upon. He has had a very severe case but is now well on the way to recovery. His many friends, both personal and in a business way, will no doubt be very much pleased to hear that he is out of danger and will be able to resume his duties very shortly.

MR. JOHN H. MERRILL, who recently resigned as auditor of the Western Ohio Railway to become permanent secretary of the Central Electric Railway Association, with headquarters at Indianapolis, was the guest of honor at a banquet given last week by his former associates in the Western Ohio. All of the roads in that district were represented, and President E. C. Spring and Treasurer A. W. Anderson, of the Central Electric Railway Association, were present and made addresses.

MR. W. M. WALMSLEY has been appointed general manager of the Sao Paulo Tramway, Light & Power Company, Ltd., of Sao Paulo, Brazil, and will sail to assume the duties of that office on March 5. Mr. Walmsley was engineer for the Electric Traction Company and Fairmount Park Transportation Company, of Philadelphia, and chief engineer and general manager of the MacAfee Company, during which time he built and operated the Augusta-Aiken Railway, the Ohio River Electric Railway, the Blue Grass Traction Company, New Orleans & Ponchartrain Railway, etc.

MR. ROBERT H. DERRAH, who has for nearly a year and a half been connected with the Boston & Northern and Old Colony Street Railway Companies as passenger agent, has tendered his resignation, to take effect March 1. Mr. Derrah leaves the service of the companies to carry out other business plans. Mr. Herbert A. Faulkner, who succeeds Mr. Derrah, is a young man of long newspaper experience, having been actively engaged in daily newspaper work for the past twelve years. For the past five years he has been successively city editor of the Brockton "Times" and "Enterprise," and came from the latter desk to this position. He has also contributed to other publications.

MR. C. O. BAKER has been appointed general freight and passenger agent of the Dayton & Western Traction Company, with headquarters at West Alexandria, Ohio, succeeding Mr. E. H. Morrell, resigned, to enter other service. Mr. Baker began his railroad career with the Adams Express Company, and filled several important positions with the express companies before accepting a position of messenger and conductor with the Dayton & Western Traction Company. During his term in the latter position he was largely instrumental in building up a profitable express business, and when the company's line was extended to Richmond, Ind., he was made representative of the passenger and express departments at that point. His appointment to his new position is considered good augury for the company, and the management is to be complimented on their selection of Mr. Baker for the position.

TABLE OF OPERATING STATISTICS

Notice.—These statistics will be carefully revised from month to month, upon information received from the companies direct, or from official sources. The table should be used in connection with our Financial Supplement "American Street Railway Investments," which contains the annual operating reports to the ends of the various financial years. Similar statistics in regard to roads not reporting are solicited by the editors. * Including taxes. † Deficit.

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O. Northern Ohio Tr. & Light Co	1 m., Jan. '06	73,235	41,619	31,616	22,667	8,949
	1 " " '05	65,465	37,092	28,373	22,917	5,456
	12 " Dec. '05	963,187	516,390	446,797	276,744	170.053
	12 " " '04	895,731	486,980	408,751	273,664	135,087
AURORA, ILL. Elgin, Aurora & Southern Tr. Co	1 m., Dec. '05	42,981	24,022	18,959	9,333	9,625
	1 " " '04	38,504	22,468	16,036	9,333	6,703
	6 " " '05	267,027	140,945	126,082	55,839	70,243
	6 " " '04	240,090	130,767	109,323	55,839	53,484
BINGHAMTON, N. Y. Binghamton Ry. Co	1 m., Jan. '06	20,471	12,476	7,995	7,376	619
	1 " " '05	18,238	11.336	6,902	7,097	†195
	7 " " '06	174,007	88,209	85,798	50,765	35,033
	7 " " '05	155,866	81,209	74,658	49,022	25,636
BUFFALO, N. Y. International Ry. Co.	3 m., Dec. '05	1,042,562	614,203	428,359	240,471	187,888
	3 " " '04	937,094	501,885	435,209	235,995	199,214
CHAMPAIGN, ILL. Illinois Traction Co	1 m., Jan. '06	233,903	125,442	108,461	------	------
	1 " " '05	191,360	102,979	88,381	------	------
CHICAGO, ILL. Aurora, Elgin & Chicago Ry. Co	1 m., Dec. '05	48,327	27,104	21,223	------	------
	1 " " '04	30,516	20,010	10,506	------	------
	6 " " '05	365,166	183,847	181,319	------	------
	6 " " '04	267,540	136,495	131,046	------	------
Chicago & Milwaukee Elec. R. R. Co	1 m., Jan. '06	43,443	22,694	20,750	------	------
	1 " " '05	24,826	14,654	10,173	------	------
	12 " Dec. '05	594,875	244,552	350,323	------	------
	12 " " 04	464,655	179,038	285,618	------	------
CLEVELAND, O. Cleveland, Painesville & Eastern R.R. Co	1 m., Jan. '06	15,858	*9,118	6,740	6,678	62
	1 " " '05	13,346	*9,737	3,608	6,663	†3,055
	12 " Dec. '05	245,089	*141,270	103,819	80,830	22,989
	12 " " '04	225,751	*136,021	89,730	80,250	9,480
Cleveland & Southwestern Traction Co.	1 m., Jan. '06	46,567	27,550	19,018	------	------
	1 " " '05	34,760	22,777	11,983	------	------
	12 " Dec. '05	543,227	314,254	228,973	------	------
	12 " " '04	475,362	293,615	181,746	------	------
Lake Shore Electric	1 m., Dec. '05	66,558	*34,758	31,799	20,404	11,395
	1 " " '04	54,778	*33,443	21,334	20,404	930
	12 " " '05	788,268	*428,588	359,680	244,850	114,830
	12 " " '04	659,873	*433,710	226,164	244,817	†18,653
DETROIT, MICH. Detroit United Ry	1 m., Jan. '06	417,831	*250,234	167,597	92,242	75,355
	1 " " '05	356,195	*229,205	126,990	93,437	33,553
	12 " Dec. '05	5,169,638	*3041522	2,128,116	1,113,293	1,014,823
	12 " " '04	4,584,582	*2763092	1,821,490	1,075,786	745,704
EAST ST. LOUIS, ILL. East St. Louis & Suburban Co	1 m., Dec. '05	128,511	57,694	70,817	------	------
	1 " " 04	115,403	45,650	69,753	------	------
	12 " " '05	1,351,576	597,452	754,124	------	------
	12 " " '04	1,363,549	596,157	767,392	------	------
FT. WAYNE, IND. Ft. Wayne & Wabash Valley Tr. Co	1 m., Dec. '05	87,327	50,329	36,998	------	------
	1 " " '04	73,260	45,473	27,786	------	------
	12 " " '05	949,498	580,832	363,665	------	------
	12 " " '04	835,231	533,295	301,937	------	------
FT. WORTH, TEX. Northern Texas Tr. Co	1 m., Nov. '05	66,271	36,247	30,023	9,938	20,086
	1 " " '04	47,634	30,621	17,013	9,100	7,913
	12 " " '05	658,906	387,077	271,829	117,372	154,457
	12 " " '04	551,716	330,244	221,472	107,911	113,560
HANCOCK, MICH. Houghton County St. Ry. Co	1 m., Dec. '05	16,853	12,139	4,713	3,786	927
	1 " " '04	17,079	13,493	3,587	3,333	254
	12 " " '05	167,067	168,643	†1,576	43,658	†45,234
	12 " " '04	199,513	135,414	64,098	40,444	23,654
HOUSTON, TEX. Houston Electric Co.	1 m., Dec. '05	46,413	29,794	16,619	8,749	7,871
	1 " " '04	38,106	23,481	14,625	8,269	6,356
	12 " " '05	517,315	313,525	203,791	105,504	98,286
	12 " " '04	357,183	314,523	42,661	96,336	†53,675
HUDSON, N. Y. Albany & Hudson R. R. Co	1 m., Jan. '06	22,858	*17,479	5,379	5,000	379
	1 " " '05	20,117	*16,980	3,137	5,000	†1,863
	6 " " '06	216,597	*160,705	55,892	35,000	20,892
	6 " " '05	188,221	*141,775	46,446	35,000	11,446
MILWAUKEE, WIS. Milwaukee El. Ry. & Lt. Co	1 m., Jan. '06	278,152	139,617	138,534	84,217	54,318
	1 " " '05	256,458	130,228	126,230	74,351	51,880
	12 " Dec. '05	3,848,696	1,551,463	1,797,233	931,016	866,217
	12 " " '04	3,285,378	1,592,414	1,692,964	916,460	776,505
Milwaukee Lt., Ht. & Tr. Co	1 m., Jan. '06	44,915	19,842	25,073	21,737	3,336
	1 " " '05	38,523	19,781	18 742	18,943	†201
	12 " Dec. '05	639,128	252,557	386,572	255,314	131,258
	12 " " '04	492,228	216,964	275,264	203,731	71,533
MINNEAPOLIS, MINN. Twin City R. T. Co	1 m., Jan. '06	407,865	205,519	202,346	109,708	92,638
	1 " " '05	351,121	175,314	175,806	97,323	78,481
MONTREAL, CAN. Montreal St. Ry. Co	1 m., Jan. '06	238,230	158,830	79,400	37,099	42,310
	1 " " '05	203,235	151,676	51,560	19.035	32,524
	4 " " '06	957,599	616,134	341,466	102,838	238,628
	4 " " '05	841,350	553,982	287,367	75,328	212,039
OAKLAND, CAL. Oakland Traction Consolidated	1 m., Dec. '05	131,375	67,348	64,027	35,026	29,000
	1 " " '04	111,154	60,441	50,713	26,525	24,188
	12 " " '05	1,441,471	740,367	701,103	392,955	308,149
	12 " " '04	1,258,136	659,261	598,875	318,550	280,335
San Francisco, Oakland & San Jose Ry. Co	1 m., Dec. '05	49,170	20.673	28,497	13,425	15,072
	1 " " '04	41,840	16,786	25,053	11,560	13,493
	12 " " '05	535,134	234,998	300,136	159,840	140,295
	12 " " '04	419,350	180,409	238,940	111,000	127,940
OLEAN, N. Y. Olean St. Ry. Co	1 m., Dec. '05	10,180	5,620	4,559	2,550	2,010
	1 " " '04	8,437	4,013	4,424	2,663	1,761
	6 " " '05	68,789	34,140	34,649	15,831	18,818
	6 " " '04	60,378	29,620	30,758	15,820	14,939
PEEKSKILL, N. Y. Peekskill Lighting & R R. Co	1 m., Dec. '05	11,904	*6,381	5,523	------	------
	1 " " '04	10,482	*6,166	4,316	------	------
	6 " " '05	68,562	*35,068	33,495	------	------
	6 " " '04	62,688	*34,201	28,487	------	------
PHILADELPHIA, PA. American Rys. Co	1 m., Jan. '06	199,901	------	------	------	------
	1 " " '05	102,742	------	------	------	------
	7 " " '06	1,048,659	------	------	------	------
	7 " " '05	853,423	------	------	------	------
ROCHESTER, N. Y. Rochester Ry. Co	1 m., Jan. '06	157,762	92,426	65,336	27,985	37,351
	1 " " '05	134,951	77,591	57,361	26,986	30,375
	12 " Dec. 05	1,787,858	973,476	814,383	332,133	482,250
	12 " " '04	1,499,719	824,490	675,228	319,970	355,257
ST. LOUIS, MO. United Railways Co. of St. Louis	1 m., Jan. '06	697,927	347,836	350,090	275,064	75,027
	1 " " '05	606,496	371,664	234,832	240,262	†5,430
	12 " Dec. '05	8,460,016	4,414,866	4,045,150	3,291,418	753,732
	12 " " '04	9,977,564	5,263,837	4,713,727	2,933,522	1,780,205
SAN FRANCISCO, CAL. United Railroads of San Francisco	1 m., Dec. '05	631,004	------	------	------	------
	1 " " '04	572,500	------	------	------	------
	12 " " '05	7,061,352	------	------	------	------
	12 " " '04	6,647,612	------	------	------	------
SAVANNAH, GA. Savannah Electric Co.	1 m., Dec. '05	54,146	37,525	16,621	10,904	5,717
	1 " " '04	48,454	32,855	15,599	10,552	5,047
	12 " " '05	586,236	348,027	238,209	127,694	110,515
	12 " " '04	544,144	316,784	227,360	126,121	101,239
SEATTLE, WASH. Seattle Electric Co	1 m., Dec. '05	235,789	155,731	80,059	23,916	56,143
	1 " " '04	208,727	150,500	58,227	25,320	32,908
	12 " " '05	2,565,914	1,674,012	891,902	291,649	600,253
	12 " " '04	2,321,235	1,609,639	711,596	295,472	416,123
SYRACUSE, N. Y. Syracuse R. T. Co	1 m., Dec. '05	90,905	50,982	39,923	20,723	19,200
	1 " " '04	79,282	46,524	32,758	19,259	13,499
	6 " " '05	510,077	282.693	227,384	123,038	104,346
	6 " " '04	440,612	248,457	192,155	121,726	70,429
TERRE HAUTE, IND. Terre Haute Tr. & Lt. Co	1 m., Dec. '05	61,063	39,678	21,385	10,988	10,398
	1 " " '04	52,070	32,510	19,561	9,222	10,339
	12 " " '05	629,760	414,518	215,243	122,418	92,825
	12 " " '04	569,429	369,005	200,424	113,873	86,550
TOLEDO, O. Toledo Rys. & Lt. Co.	1 m., Dec. '05	175,744	*84,697	91,047	42,460	48,587
	1 " " '04	165 929	*77,836	88,093	41,693	46,400
	12 " " '05	1,913,456	*972,994	940 462	510,307	430,155
	12 " " '04	1,752,833	*923,208	829,625	499,874	329,751
YOUNGSTOWN, O. Youngstown-Sharon Ry. & Lt. Co	1 m., Dec. '05	54,197	*25,690	28,507	------	------
	12 " " '05	546,487	*286,452	260,035	------	------

Street Railway Journal

Vol. XXVII. NEW YORK, SATURDAY, MARCH 10, 1906. No. 10.

Published Every Saturday by the

McGraw Publishing Company

Main Office:
NEW YORK, Engineering Building, 114 Liberty Street.
Branch Offices:
Chicago: Monadnock Block.
Philadelphia: Real Estate Trust Building.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York"; "Stryjourn, London"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada, Mexico and the Canal Zone.

Street Railway Journal (52 issues)......$3.00 per annum
Single copies ......10 cents
Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August & November) $4.00 per annum
Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy)......$6.50 per annum

To All Countries Other Than Those Mentioned Above:
Street Railway Journal (52 issues), postage prepaid...... $6.00
25 shillings. 25 marks. 31 francs.
Single copies ......20 cents
Remittances for foreign subscriptions may be made through our European office.

NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the Street Railway Journal.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires.

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal, 8000 copies are printed. Total circulation for 1906 to date, 82,300 copies, an average of 8230 copies per week.

Protection of the Right of Way

With the growth in number all over the country of high-speed roads, operating over their own right of way, the question of interference with the high-tension distribution system by storms assumes a serious aspect. A few weeks ago Chicago was temporarily cut off from telegraphic communication with other parts of the country, except in one direction, as the result of a snow storm, and hardly a winter has passed without similar trouble at some other important city. Of course, power transmission lines are erected in a very much more substantial way than telegraph lines, and their owners have practically nothing to fear from snow, but where the railroads extend through a wooded country there is sometimes danger of injury to the aerial lines through falling timber. For this reason it is an excellent plan for the company to secure the right to protect its wires against danger of this kind, and this can usually most easily be done when the right of way is secured. We know of one company which has had inserted in all of its deeds that the grantee "has the right to cut and keep cut all timber on land adjacent to the right of way which interferes, or is likely to interfere, with the lines, poles, fences or operation of the railroad." A provision of this kind is usually not difficult to secure at the time, but may be of the greatest benefit if the railroad company takes care that the right of way is protected in the way permitted by the grant.

Speaking of deeds for right of way, another suggestion might be made in regard to fences. It has been established in most, if not all, States that a barbed wire fence is a legal fence. Nevertheless, it is true that fences of this kind are not very popular with farmers, who usually prefer a woven wire fence. For this reason it will often not be difficult, in drawing up the deeds for a right of way, to provide that the grantee shall install a woven wire fence, provided the grantor keeps it up, and as this is in the deed, it is a permanent record in case any question should arise as to the future responsibility for the maintenance of the fence. This clause is used in the deeds of one of the large interurban railways in Indiana, which also follows the practice of introducing a clause to the effect that the grantor agrees to keep shut all gates at private crossings, except when these gates are actually in use.

The Montgomery Situation

A curious condition of affairs exists at present in Montgomery, Ala. For a number of years the city, which has about 35,000 inhabitants, has possessed two street railway systems, which have been operated by independent companies. No transfers were given from one line to the other, and there was a considerable amount of duplicate trackage in the center of the city. Several months ago the smaller company passed into the hands of outside capitalists, who immediately made arrangements for consolidating the two systems and installing universal transfers. To do this, they ask permission from the city to lay a few cross-overs and switches to connect the two systems, and offered in exchange to give a universal transfer, to sell tickets to school children for 3⅛ cents, to erect a new car house and to make other improvements which would better the service. In most other cities, the fact that two rival street railway companies had come under one control, would promptly be made the basis of a request by a municipality upon the owners to grant a universal transfer, and make such connections as were required for uniform operation. Not so in Montgomery, however. The city fathers immediately became suspicious that an undue advantage was being sought. They said that if the two companies wanted to consolidate, they ought to pay for the privilege. They then announced that consent would be given only upon an agreement on the part of the consolidated company to pay 1 per cent of its gross receipts to the city during the first ten years, and 2 per cent thereafter; give passes to city officials, aldermen, firemen and policemen, and do sundry and various other things which seemed to form a quid pro quo for the privilege of giving the citizens of Montgomery a longer ride for 5 cents than they ever enjoyed before.

We are glad to note that the company has not yet accepted this remarkable answer to its plans to improve the city's transportation facilities. It is also satisfactory to learn that the citizens of Montgomery seem to understand the merits of the controversy. To test the popular sentiment in this regard, the company recently made a postal card canvass of about 1750 of the prominent residents of the city. Out of this number, some 1500 cards were returned, and of these only 6 per cent upheld the policy of the council. In view of this progress which the South is now making and its anxiety for capital to develop its industries, the action of the Montgomery authorities is so peculiar that we look upon it as exceptional, and as not representing the general sentiment of the South toward industrial betterment.

Reserve Equipment in Sub-Stations

The amount of reserve equipment which should be installed in a sub-station is a question of considerable interest in these days, when the efforts of designers are bent so constantly upon securing continuous service at all hazards in important systems. On the one hand, we find the opinion held that a spare unit should always be available for immediate service in case of a breakdown, or at least sufficient overload capacity in the rotaries, transformers or motor-generators to take care of the traffic in case any single machine goes to the bad. On the other hand, the extra cost of reserve power in sub-station equipment deters many engineers from prescribing any margin above the normal daily requirements, which include, of course, the ability to carry the peak loads without injury.

As a general rule, it is not necessary to carry a complete reserve equipment in sub-stations, but in large city installations containing several high-powered units, it is a pretty good plan to have at least one spare rotary and one set of transformers available in case anything goes wrong, or else to provide larger units in the first place than the immediate traffic requires. In a large system, where the volume of traffic is very heavy, a company can afford to carry a larger investment as a security against interruptions than would be permissible on a small road. In some cases the spare unit need not have more than half the rating of any one of the other machines. Perhaps, the best way out of the problem is to maintain a portable sub-station equipment. This obviates supplying the reserve equipment in the different sub-stations as fixed apparatus, but on systems where the sub-stations are a good many miles apart the time required to bring the portable set into action at the place needed is likely to be so great that the arrangement is of no value in tiding over anything but very severe breakdowns.

When a sub-station is equipped with motor generators, there is still less need of reserve power than with rotary converters, for, in case of trouble, it is not a very difficult matter for the other sub-stations to raise the voltage enough to supply power from outside the area normally served by the crippled station. Somewhere on every system there should be a spare transformer which can be substituted for a burned-out unit, even if this involves the purchase of a large three-phase unit. Every sub-station should carry reserve parts of its switching equipment, lightning-arrester sections, carbon brushes and flexible cable, circuit-breaker parts and the like. These supplies cost comparatively little, and the only real question in the matter of reserve apparatus, is in connection with the generating and transforming units. To a certain extent, the power factor of the rotary sub-station can be held up by stiffening the field excitation of the converters, and the voltage controlled by induction or transformer regulators, but the flexibility is much less than with the motor generators. As for the alternating current sub-station, pure and simple, there is ordinarily not much object in installing extra transformer capacity on the premises, for the exacting conditions of very heavy railway work justify reserve capacity which small city and interurban lines could ill afford.

Choke Coils on Cars

The importance of choke coils in connection with car lightning arresters is not always appreciated as it should be. Cars are occasionally encountered without any choke coils whatever; and, again, the choke coils on many cars consist of but a few turns. General information upon the behaviour of lightning under all conditions is very meagre, and for this reason the value of the choke coil is not definitely known. But the action of lightning on the controller blow-out coil, the field coils and the armature coils appears to be such as to warrant putting a great deal of faith in any coil that has a choking effect. What causes many to belittle the importance of choke coils, is the fact that at times lightning passes through them and does damage to the motors when the lightning arrester is in good order. This will be shown by the arrester taking care of a discharge at some later date, without having been altered or repaired in the meantime. But instances are frequent where the lightning discharge jumps across a ⅜-in. gap at the trolley terminal of the blow-out coil of a controller, rather than go through the coil. Evidently, whenever this happens, something is wrong with the lightning arrester. But the fact that such a gap is bridged, proves rather effectively that choke coils do have their place on a car.

Theoretically, the choking effect of a coil should vary with the square of the number of turns, so that a coil with twenty turns should be four times as effective as one with ten turns. This being so, there does not seem to be any very good reason why the coils of car lightning arresters should be limited as they are to twenty or thirty turns or less, where there is considerable trouble from lightning. The use of a coil of many turns, say 50 or 100, would, of course, result in some loss of energy in the coil, but the cost value of this loss would be but a small per cent of the amount saved in the car-maintenance department if such a coil shielded the motor and equipment from lightning. To eliminate loss of energy in the coils, a short-circuiting switch might be placed across the terminals of the coil, and the car operated in ordinary weather with the switch closed. Motormen could be instructed to open these switches during thunder storms or at times when lightning is threatening.

Lighting circuits, in particular, could be better protected from lightning than is the usual custom. To permit use of the lamps when the circuit breaker is off, it is customary to take these circuits off the main circuit between the trolley and the circuit breaker. This deprives the lamp circuits of any shielding effect from the choke coil, as the coil is usually placed on the ground side of the circuit breaker. It ought, however, to be very little trouble to place a small choke coil in the light circuit just after it leaves the main circuit, and this will usually give the desired protection. Some railway engineers believe in letting lightning play havoc with the lighting circuits without objecting. They argue that whenever lightning grounds these circuits, the motors have been shielded, and a greater repair expense avoided. Arguing along the same lines, however, a still smaller expense would be entailed if the circuits were properly protected and lightning arresters, rather than the light circuits, were made to divert the lightning.

Progress in Reorganization of the A. S. and I. R. A.

Those who have kept in intimate touch since the Philadelphia convention with the work accomplished by the American Street and Interurban Railway Association, are fully satisfied that the plans decided upon at that time and since pursued, were wise. To those who have not had occasion or opportunity to follow this work as closely, the progress made may be somewhat in the nature of a surprise, but will certainly be gratifying. The predominant aim of those who have the administration of the affairs of the association in charge, has been to create an organization which will accomplish results. In this way, and in this way only, will it be possible to add to the membership any large proportion of these companies which have not hitherto affiliated themselves with the body. That these companies can now see a direct benefit from membership is shown by the report of the secretary at the meeting of the executive committee held in New York last month, which stated that more than fifty companies had joined the association since the new constitution was adopted. This is an increase in members of about twenty-five per cent, and indicates that the co-operative plan of work now pursued is appealing to a very large percentage of both members and non-members.

The fear on the part of some—a fear which was implied rather than expressed at the Philadelphia convention—that the merger of the Mechanical or Engineering Association and of the Accountants' Association with the main association would result in the curtailment of the usefulness of one or both of these bodies, has disappeared entirely among those who have had the direction of their affairs in charge. Their new constitutions and by-laws have finally been revised, and it is evident that the effect of the reorganization upon them will be not only greatly to enlarge their scope, but to give their conclusions a standing and a force which they could never secure when formulated by an independent organization. Both associations, as well as the Claim Agents' Association, will also be greatly assisted throughout the year in their work by the permanent secretary, who is available for compiling such statistics and information as they require. This service will be in addition to and will not interfere with that which was formerly and still will be performed by the secretary of each affiliated organization.

The field of each association is becoming more clearly outlined. In the future, all engineering topics will be discussed by the Engineering Association, to whom they properly belong, while all accounting topics will similarly be treated by the Accountants' Association. This means that many of the subjects hitherto considered by the main association will be delegated to one of the affiliated associations, but it does not follow that the meetings of the main body will decrease in importance. On the contrary, the new plan of division of the work will afford the main association an opportunity of taking up a large variety of topics, which hitherto have received hardly any attention—topics which not only vitally affect the street railway interests of the country, but in which a tremendous amount of good can be secured through co-operative effort. As in practically all other large deliberative bodies, it is proposed to carry on a great deal of the preliminary consideration of these topics by committees. Thus, committees on the following subjects have already been appointed by President Ely: "Standards," "Compensation for Carrying United States Mail," "Insurance," "Papers and Topics," "Public Relations," "Municipal Ownership," "Welfare Work," "Heavy Electric Railroads," and "Promotion of Traffic." Each of these committees is on an operating subject, and each, with the exception of the committee on standards, which will work in conjunction with the affiliated associations, and that on papers and topics, is expected to render a report at the next convention. The papers secured by the committee on papers and topics will also be devoted to operating subjects or questions of policy, and consequently will be of more interest to the majority of the association members than some which have been presented during the past few years, no matter how ably the papers themselves were prepared or how thoroughly they covered the topics chosen. The enthusiasm with which the members of the different committees of the various associations have assumed their duties augurs well for the success of the next convention.

The first year in the life of an organization of this kind is always a critical one. A certain number of individuals in every industry can be depended upon to give active assistance in any co-operative work. It is the tendency of a large number of others to hold back at first to see what will be accomplished. Success is assured, but it remains with those who have not yet joined to determine whether the greatest possible benefit of which the association is capable, will be attained. It should have a very much larger number of members than did the old association and it should be a more representative body. Roughly speaking, the benefits conferred by membership, as compared with the old association, are in the ratio of 365 to 3, because the benefits are continuous throughout the entire year instead of being confined to three convention days. And, if its membership does not increase in this ratio it should only be because there are not that number of railway companies in the country.

OPERATING FEATURES OF THE DAYTON & TROY RAILWAY

The Dayton & Troy Electric Railway, of Dayton, presents an excellent example of a comparatively small road, which has developed into a splendid proposition through the application of modern and progressive business methods. Unlike a great many roads, it has not been the policy of this company to force the operating expenses below the magical 50 per cent of gross receipts, or to pay dividends at the expense of the physical condition of the property, but rather it has been the plan to spend money freely, some might think almost prodigally, in improvements, maintenance and advertising. Such a course has been possible without objections from security holders, because there are no bondholders to require semi-annual interest, and the stock is very closely held by persons who have been satisfied with a moderate rate of dividends.

STRETCH OF DOUBLE TRACK

The road extends from Dayton to Piqua, a distance of 30 miles, and is part of the through line from Cincinnati to Toledo. On several occasions attempts have been made to buy the road in order to amalgamate the various links into one line, but the holders are not desirous of disposing of their property, being satisfied that it is capable of greater development by their own methods. The company has a capital stock of $1,000,000, half preferred and half common. The preferred has not been on the market in some time, while there is a standing bid of $125 per share for the common, with no sales for many months. The property is practically owned outright by the families of C. B. and H. P. Clegg, of Dayton, and the latter is president and general manager.

CURVES, GRADES AND SWITCHES

As laid out, the road had many curves and grades, a portion paralleling a highway and the balance along a canal bank, but it has been improved and developed into one of the fastest stretches of track in the country. During the past two years about 12 miles of double track have been laid and all sidings lengthened, so that it is seldom that a car has to stop for passing points. The track was all lifted from 8 ins. to 15 ins. with coarse washed gravel obtained from a river bottom. Curves were elevated from 4 ins. to 7 ins. The elevations start back several hundred feet with long spirals, and are figured out for a speed of 55 miles an hour. Practically every curve is double track with 13-ft. centers to allow for passing at full speed. The tracks pass through all of the smaller towns at the rear of the main street on private right of way, so that in a number of towns the limited cars do not even hesitate. Switch leads are 160 ft. long and spring switches are used exclusively. Cars invariably enter these switches at full speed, but there has never been an accident or split switch. It is believed this is due largely to the system of inspection. Two track walkers pass over the road every day, each covering 15 miles. The men are well paid, and they are not permitted to ride under any circumstances. They inspect all joints and switches, and on bad days are required to give extra attention to switch points. Points are never permitted to become worn beyond a degree of perfect safety. In winter there are two gangs of six men each and in summer two gangs of fifteen men each, not including the track walkers. Track maintenance averages 80 cents per mile per day the year around. Views of typical stretches of track and track work are presented.

WHEELS

On local cars the company uses a 37-in. wheel, 3-in. tread, 1¼-in. flange with 1⅛-in. throat, and on limited cars a 39-in. to 40-in. wheel, with 3⅛-in. tread, 1¼-in. flange and 1⅛-in. throat. Steel-tired wheels have been used with great success for a number of years; those furnished by the Standard Steel Works, Philadelphia, are employed as standard. The larger wheels have a 4-in. tire and show a life of from 450,000 to 500,000 miles. The large wheels give a steadier riding effect and greater speed, as the limited cars are geared higher. Solid gears with 5-in. face are used.

REPAIR SHOP

The shop at Tippecanoe City is equipped with a 42-in. Hamilton wheel lathe, a Bradford 30-in. lathe, a Smith & Mills 16-in. shaper, a 150-ton Niles wheel press, several small lathes, drill presses, etc. The line shaft is motor driven. An air-compressor outfit supplies blast for a blacksmith shop, for blowing out cars, armatures, etc. There is a trolley-carrier system in the shop for handling heavy pieces from one machine to another. The wheel lathe, which is illus-

DOUBLE-TRACK REVERSE CURVE

trated, is served by a swinging crane and wheels are handled with this and turned without removing them from the axles. The practice is to run steel-tired wheels 60,000 miles, and then turn off ½ in. The cost per turning per pair is about $1.10. A spring bolster is used with oiling devices on the bolster plates and side plates, which tends to increase the life of the wheels. A transfer table with air lift has been installed, and all work of removing and inspecting armatures, brushes, etc., is done from below, and all trap doors have been dispensed with. To eliminate danger of fires in cars, all wiring is run in conduits, and asbestos and double rubber-covered wire is used. Electric heaters have been replaced with hot water heaters. All cars have recently been double floored, and two thicknesses of building paper are placed on the original floor with a hard pine floor above. All limited cars are carpeted. All local cars have leather-covered seats, while cane-pantasote upholstered chairs are used on the limiteds. A timber pilot of the type illustrated is used exclusively.

WAITING ROOM AT TIPPECANOE, TELEGRAPH OFFICES IN ALL STATIONS

INTERIOR OF TROY FREIGHT STATION

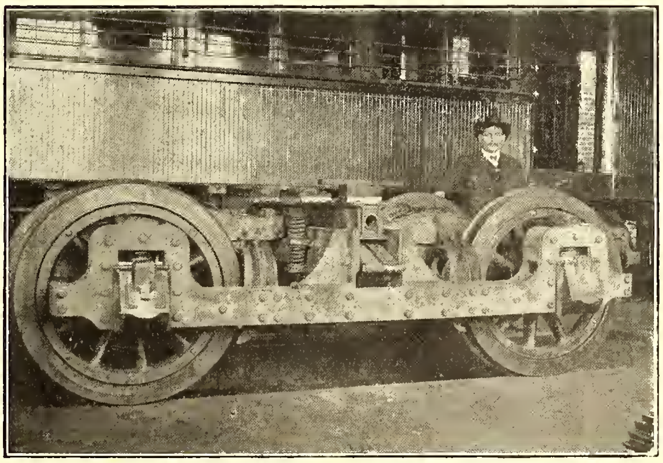
BEARINGS

For armature and axle bearings the company uses White's No. 1 babbitt. These bearings are cast in the company's shop and are made three times the diameter of the shafts; a highly polished mandrel is used in casting, so that it is not necessary to turn the bearings. Oil lubrication is used exclusively. Westinghouse No. 76 motors are employed. The standard grease cup is retained, and a screen is placed at the bottom of the cup, which is then packed with wool waste and saturated twice a day. Lubrication costs 11 to 13 cents per thousand miles with motor oil at 15 cents and journal oil at 9 cents. It is claimed that the saving in cost amounts to about 25 per cent, and there is a saving in power of 30 per cent as compared with grease lubrication. Cars formerly required 5 kw per car mile, while now they require only 3½ kw. The saving in repairs is also very large. Wood gear cases are not used as they are deemed undesirable for high speed.

EXTERIOR OF TROY FREIGHT AND PASSENGER STATION

TROLLEY WHEELS

Kalamazoo 6-in. trolley wheels are employed, and give a life of from 3500 to 5000 miles. They have oil lubrications and an extra pair of holes is drilled to give additional lubrication. The practice is to use a wheel several days on the limited runs, and then change it to a local car. The Standard trolley stand is employed. This base has a steel pin in a cast-iron hub, and it is the practice to remove the cast-iron piece and substitute babbitt, which gives a very free movement to the base. On local cars the tension on trolley bases is 28 lbs. and 34 lbs. on limiteds.

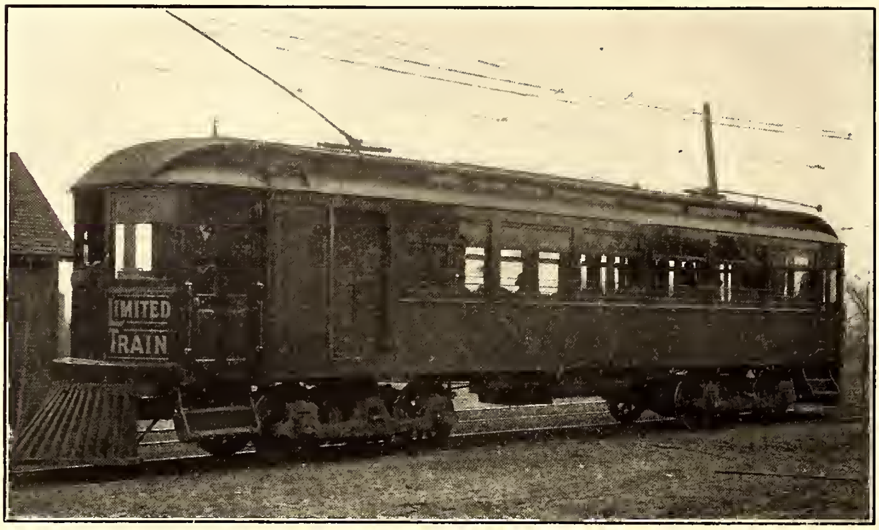


TRUCKS WITH 39-IN. WHEELS

CLEANING AND INSPECTION

Great care is used to keep cars clean. Floors are scrubbed daily by women using a special car cleaner made by James Brothers, Dayton. One woman cleans two cars inside, washing all wookwork with damp cloth, while one man washes four car bodies and windows outside. Windows are washed with warm water and sponge, and polished chamois.

"Big Four" orange with brown trimmings is the standard color. This costs 30 per cent more than Pullman color to maintain, but it is deemed a good advertisement. In finishing, three coats are rubbed in with pumice, then three coats of body, and three coats of varnish. The Dayton & Troy monogram is placed on the side of the car in brown and gold, and the lettering is in gold. The limited parlor cars bear names instead of numbers.



PARLOR LIMITED CAR

Limited cars are inspected and lubricated each round trip of 160 miles, and they go to the shop every third day for an overhauling, the master mechanic giving his individual attention to these cars. Local cars are inspected nightly. One man inspects motor brushes, circuit breakers, air governors and car controllers, another does the pit work adjusting brakes, rigging, motor clearances, etc, while a third

INTERIOR OF PARLOR LIMITED CAR

man attends to trolleys and lubrication. Circuit breakers are tested every six months with a water rheostat, and they are set to throw at 425 amps.

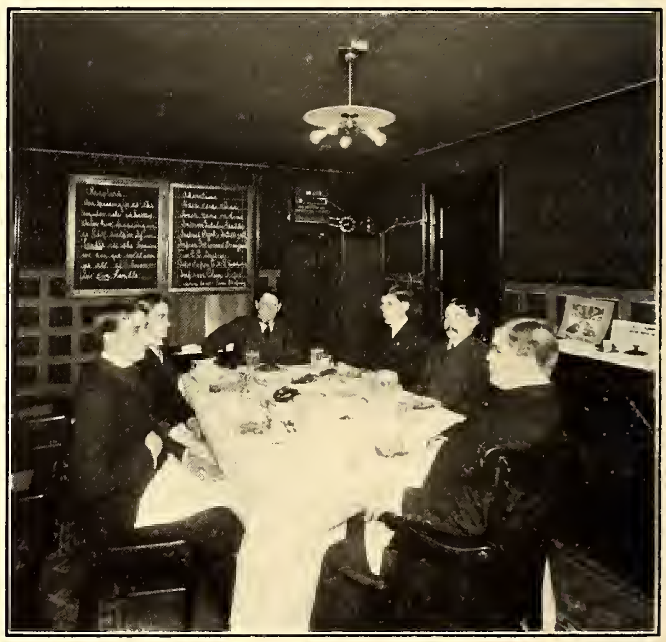
The company has done a great deal of car rebuilding, and has altered all of its interurban cars, giving them practically four compartments with five bulkheads. The cars are 51 ft. long. The first compartment is for baggage, the second has the toilet room on one side, and a rack for grips and a box for the conductor on the other, the third is the smoking compartment and the fourth is the passenger compartment. The parlor cars have the same interior arrangement, except that there is a wash room opposite the toilet room. The company is installing several modern wood-working tools, and expects to build its own cars in the future.

SNOW PLOWS

An interesting home-made snow plow was built some time ago from an old flat car. It is not equipped with motors, but is pushed by a motor car. There is a 14-ft. blade in front attached to a swivel at the end of a timber draw-bar. By means of a chain operated by a brake staff this blade can be adjusted for height or it can be turned to throw the snow in any direction at either side. Between the trucks is another wing set at an angle of 45 degs., with the track which can be raised or lowered by a pair of ratchet levers. The front wing is unusually sufficient to clear any snow encountered in this district, and at a fair speed it will throw 10 ft. beyond the rail. Both wings are used in heavy drifts; the front is elevated several inches to take the worst and throws the snow in one direction, while the other serves as a scraper and throws it in the other direction. In heavy weather the car is weighted with rails or ties.

OFFICERS' CLUB

One of the novel features of the company's organization

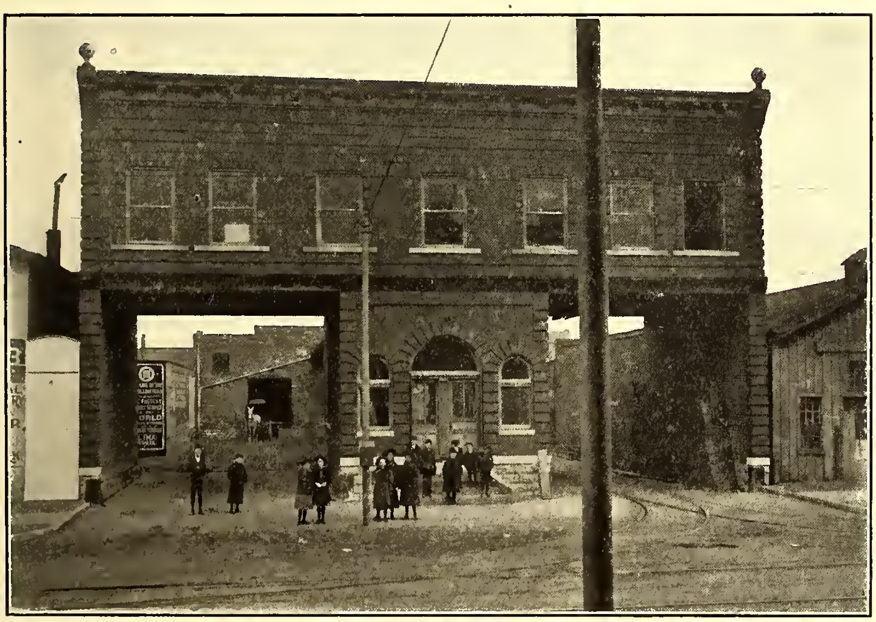


OFFICERS' CLUB AT LUNCH

is the officers' club. The various heads of departments meet every noon and have lunch at the company's expense, a room near the headquarters being fitted up for their exclusive use After participating in the best that the market affords, perfectos are handed out and the officers have a heart to heart talk covering all topics of operation and improving the business. There is a leaved blackboard upon which are posted all manner of instructions and suggestions, each department head having a section on the board. Frequently there are papers on certain subjects. Motormen and conductors are called into the club room at intervals, and explained the workings of new apparatus or regulations. Considerable attention is given to instruction of motormen in the matter of accelerating and current consumption. In the club room is a circuit cut in from the trolley line, with instruments showing the current consumed in a certain section. Motormen who are careless in this matter are shown that they are wasting current as compared with other men making the same runs. At frequent intervals the officers make an inspection of the road, using an old car fitted up for the purpose. Much attention is paid to improving the appearance of the right of way and surroundings of stations. In a number of instances where there are unsightly buildings, quick-growing shrubbery and trees have been planted. Prizes are given to schools making the most attractive improvements, and station agents are similarly encouraged to improve appearance of buildings and yards.

ADVERTISING

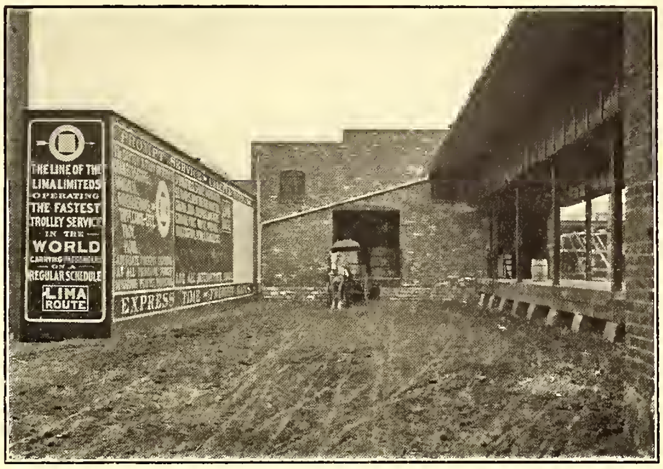
The company is liberal in its advertising expenditures, and a special man is employed who devotes his time exclusively to this work. Sign boards all over the district announce the advantages of the "Lima Route" of the "Lima Limiteds." Advertising contracts are carried with nearly forty daily and weekly newspapers. Every special event, opening up a new route of connection, improvement in the freight or passenger service, etc., is heralded not only by display advertisements, but by neatly-worded reading articles, which are live news. A certain amount of cash is paid for this service, but the greater part is traded out in transportation and by carrying papers. The Dayton papers are distributed over a territory by means of connecting lines,



FREIGHT STATION AND GENERAL OFFICES IN DAYTON

so that they arrive several hours ahead of Cincinnati and Toledo papers, thereby greatly increasing their circulation and prestige. Records are kept of this service, and stamps are issued to the papers at 1 cent a pound.

A passenger and freight solicitor is kept constantly busy working up new business, and some interesting and diplomatic work has been done. Transportation properly placed with hotel men has resulted in advertising cards in all lobbies in the district. The solicitor works up excursions for societies to attend entertainments or meetings in other towns, and where parties are large enough, they are given special cars with fast runs. Special excursions to the plant of the National Cash Register Company in Dayton, form an interesting departure. Whenever a certain number of people can be gotten together and delivered at its plant, this company gives a luncheon, a free entertainment with lantern views of foreign tours and an inspection of the mammoth plant. The Dayton & Troy passes its door, and has run numerous excursions from all points in the district. On national and



TEAM SIDE, DAYTON FREIGHT STATION

State elections, excursions are run between all points, and election returns are read in all cars and stations. Hunting excursions, holiday, week-end excursions, etc., are a specialty. In handling large fair crowds last year, special excursions were run from all points, and at the fair grounds, partitions were built leading to cars for various points, each car handling people to a certain point and running on limited schedule to that point without other stops. A despatcher's office was erected at the grounds, and all cars were handled from there; there were no delays or accidents. Unlike many roads in this district, the company does not favor the operation of parks, nor care for parks on its line. The park traffic is usually a short haul only, and interferes with regular traffic at the time when it is heaviest—mornings and evenings. A park which it operated for several years has been abandoned.

INTER-LINE BUSINESS

The company has been a leader in the development of interline and long-distance business, not only in connection with electric roads, but with steam roads as well. Recently, it worked up considerable business among homeseekers, and sold a number of tickets to Oklahoma, Texas and other Southwestern points, tickets being sold through without the use of exchange orders. Through tickets are sold to a large number of distant points, and baggage is also checked through by the use of duplicate checks.

This is one of the few roads which interline all cars with another road. All local passenger cars run from Dayton to Wapakoneta, and limited parlor cars run from Dayton to Lima, part of the way on the Western Ohio Railway. The latter run is 80 miles, which is covered in 2 hours and 30 minutes. This is said to be the fastest regular electric schedule in the country. For some time the company operated a special known as the "Clover Leaf" special, which ran to Delphos on the Ft. Wayne, Van Wert & Lima line, to connect with Clover Leaf (steam) trains from Toledo and St. Louis. The train made 95 miles in 3 hours, and the return trip at night in 2 hours 35 minutes. This run was abandoned on the opening of the electric connection to Toledo by way of Findlay. As announced in a recent issue, electric service is soon to be extended through to Toledo, and cars will make the 162 miles from Dayton to Toledo in 5½ hours. The chair cars used in this service are owned exclusively by the Dayton & Troy. Excess is charged for chair cars on local trips, but not on interline trips. Under the agreement, each road collects and keeps its own fares, and excess, but the Dayton & Troy receives a car mileage for the use of the car while on another road. With the local cars, each road keeps all the fares it collects and pays its own crews, the distance being practically the same on each road. Local cars connect with cars on the Western Ohio main line for points north, and the limiteds connect with the limiteds on the Fort Wayne, Van Wert & Lima for a record of time of arrival and departure of all trains and reports these movements to the despatcher. The line is covered by the system of the Postal Telegraph Company, with instruments in each station so that messages may be transmitted by this means, if desired.

FREIGHT BUSINESS

There has been considerable discussion among interurban managers in this district, as to the most desirable methods of handling freight and express, so-called. For several years the business on this road was handled by the Southern Ohio Express Company on a car-mileage basis. The traction company furnished the cars and the motormen, and the rates were practically the same as express rates. Some months ago this arrangement was abrogated, and instead of retaining express rates or rates between express and freight, the company has launched out with a purely freight business in connection with the steam roads. It has induced

Freight vs. Express

No express is handled by the Dayton and Troy System (415 East First street), and all the merchandise which is unloaded on their platform goes to Piqua, Springfield, Sidney, Wapakoneta, Celina, New Bremen, Minster, St. Marys, Lima, Delphos, Van Wert, Ft. Wayne, Huntington, Wabash, Peru, Logansport, and many other points.

Exclusively at Competitive Freight Rates

If you ship freight it will be worth your while to have our freight man call. Drop a card or call up

THE DAYTON & TROY SYSTEM
415 E. First St.
Dayton, O.
Telephone—Bell 1456. Home 6511

NEW POINTS REACHED VIA The Dayton and Troy ELECTRIC RAILWAY SYSTEM

Tickete ere now on sale to the following stations:

	One Wey.	R. T.
Beaver Dam	$1.70	$3.05
Bluffton	1.85	3.30
Mt. Cory	2.00	3.55
Rawson	2.05	3.65
Findlay	2.25	4.00

Bowling Green, Maumee, Toledo and Detroit.

All the Way by Electric Lines

Connectione are made for the above pointe at Lima. Car leaving Lima every two hours from 6 a. m. until 10 p. m., for Findley.

For information inquire of D. & T. Ticket Agent, 7 North Jefferson street.

(Piqua Fast Line.)
SPECIAL RATES.
ONE WAY.

Tippecanoe	30c	Botkins	$1
Troy	35c	Wapak'eta	1.15
Piqua	50c	St. Mary's	1.35
Sidney	75c	Celina	1.55
Anna	90c	Lima	1.45

ROUND TRIP.

Tippecanoe	55c	Botkins	$1.75
Troy	65c	Wapak'eta	2.05
Piqua	90c	St. Mary's	2.40
Sidney	1.35	Celina	2.75
Anna	1.60	Lima	2.55

30 dey limit on ell tickets.
Heurly traine in eech direction.

WEEK END RATES.

The Dayton & Troy System of Electric Railwaye are also selling every Saturday Tickets to tha following points on the Western Ohio Railway, good going Saturday and Sunday, returning Monday, at the following low ratee:

To Sidney	$1.05	Wapak'ete	$1.60
St. Mary's	$1.85	Lima	$2.00
Celina			$2.10

Note the liberal time allowances.

Make your trip the more enjoyeble by going and coming when you chooee, not being hampered by the arbitrariness of the eteam road schedule.

Baggage checked on all limited traine to Piqua, Sidney, Wapakoneta and Lima only, at a uniform price of 25c per piece. Conductors will furnish on request transfer, carrying passengers to any point on the Piqua local lines.

NOTE—All regular traine of the Dayton & Troy system of electric railways make connection at Troy, O., with the traine of the Springfield and Troy Electric Railway and through tickets may be purchased to Casstown, Addison, Christiansburg, Springfield, etc., at all officea and stations of the D. & T. system.

Thanksgiving Day .....Rates....

—THE—

DAYTON & TROY,
System of Electric Railways

Will offer very low round trip rates to the following points:

Dayton to Springfield and return	75c
Dayton to Sidney and return	$1.20
Dayton to Anna and return	1.45
Dayton to Botkins and return	1.60
Dayton to Wapakoneta and return	1.80
Dayton to St. Marys and return	2.00
Dayton to Celina and return	2.30
Dayton to New Bremen and return	2.20
Dayton to Minster and return	2.30
Dayton to Cridersville and return	2.00
Dayton to Lima and return	2.20
Dayton to Delphos and return	2.75
Dayton to Van Wert and return	3.20
Dayton to Ft. Wayne and return	4.20

Tickets Good Going November 29 and 30; Good Returning until December 4.

No excess Fare on Limited Trains, provided tickets are purchased before entering the cars.

Elegant Library Chair Cars Dayton to Lima—Velvet seated coaches Lima to Delphos, Van Wert and Ft. Wayne, Ind.

Only one change of cars between Dayton and Ft. Wayne.

You step from one car to the other at Lima.

The finest, cleanest, fastest, best, cheapest.

Trolley Service in the World

Ask the agents of the

D. & T. System,
7 North Jefferson Street.
Phones Bell 508. Home 2508.

THE
Dayton & Troy
System of Electric Ry's.

are now selling one way and round trip tickets from

Dayton to Ft. Wayne, Ind.

VIA THE

D. & T., W. O. & Ft. W., V. W. & L.

UNION STATIONS AT ALL TERMINALS.

Regular hourly service from Dayton and

FIVE—FAST LIMITEDS—FIVE
ALL MAKING DIRECT CONNECTIONS AT LIMA.

ADVANTAGES!!!

Fastest Time.
Lowest Rates.
A Clean, Comfortable Ride.
Moveable Library Chair Cars, Dayton to Lima.
Velvet Seated Coaches, Lima to Ft. Wayne.
Only One Change of Cars, at Lima.
Baggage Checked Through.

Fare One Way, $2.75
Round Trip . . $4.95

NO EXCESS FARE ON LIMITED TRAINS IN EITHER DIRECTION.
Provided Tickets are Purchased Before Entering the Cars.

TYPICAL NEWSPAPER ADVERTISEMENTS, PUBLISHED BY THE DAYTON & TROY ELECTRIC RAILWAY COMPANY

points in Indiana. Business for Springfield and points east, is done with the Springfield, Troy & Piqua, which connects at Troy, and runs a chair limited to connect with the "Lima Limiteds."

This chair car service has been quite a decided success. It is practically as fast as the steam road, and the cars are uniformly on time. Chair seats, tables, magazines, daily papers, wash-room facilities and baggage on every car, without excess fare, are among the drawing cards of the service. Limited cars on this line earn about five cents per car mile more than local cars, and, as nearly as can be ascertained, they cost about 25 per cent less to operate on account of fewer stops, which effect both the life of the equipment and the power consumption.

DESPATCHING

Despatching is by telephone, with steam railroad rules and forms. Despatching orders are issued at terminals, and other orders are issued largely through station agents. There are semaphores at each station, and each station agent keeps

other roads to go into this arrangement, and at present it has working agreements with the Springfield, Troy & Piqua Traction Company, the Western Ohio Railway, the Toledo Bowling Green & Southern, the Fort Wayne, Van Wert & Lima Traction Company, the Dayton & Western Traction Company, and several other roads, whereby freight may be shipped over a wide district covering all of Western Ohio and many points in Indiana. Some of the roads continue to do an express business, but the Dayton & Troy is committed to the purely freight business. The arrangements with other roads is on a pro rata basis, governed by the distance covered. The standard steam classifications are used, and steam rates are met on practically anything. While no attempt has been made to handle coal or ore, the companies are handling bulky articles like ice, machinery, tobacco, whiskey in barrels, and merchandise of every description. The higher classes of freight are of course catered to, and there is a minimum charge of 25 cents for any package, which, of course, brings the average receipts per car higher than those of a steam road, but a strong point is made of competitive rates with practically express service minus wagon service.

Stations have been fitted up in all towns, with team tracks, side tracks and covered warehouses. Views of some of these stations are presented. At Dayton, a fine terminal station has been erected, and the lower floor is used exclusively for the freight service. The second story is devoted to the general offices of the company, and has ample space and facilities for all departments. In the rear of the freight office is a two-story warehouse. Back of this warehouse is a track connection from a steam railroad, so that freight from steam cars can be unloaded or loaded without wagon transferring. At one side are two tracks with a capacity for six cars, while team platforms are on the other side. The exterior of the building is pressed brick with stone trimmings and the offices are handsomely finished in hardwood. The station is used jointly by the Dayton & Troy and Dayton & Western, which are closely affiliated, although the station is owned by the former. Each company has its own agents. The station serves as the clearing house for business north, east and west, as there are lines leading in these directions in the arrangement. Freight runs are as follows: Dayton to Piqua, 12 m.; Dayton to Troy and Springfield, by way of the Springfield, Troy & Piqua, 2 p. m.; Dayton to Lima, via Western Ohio, 5:45 p. m.; Dayton to Piqua, 6 p. m.; Tippecanoe & Lima, 10 p. m. The run to Tippecanoe is at night, and the car does local work between Tippecanoe and Lima next morning. At Lima, transfers are made to points in northern Ohio and northern Indiana. Thus far all cars are operated singly, and are ordinary express cars with two large double doors on each side. The Springfield, Troy & Piqua has five box-trail cars, which have been used in Dayton, and the Dayton & Troy is building five. They will have box-car framing, hood roof, two end and two side doors. They will have capacity of 60,000 lbs., and will be fitted with automatic air brakes, large flange wheels, long drawbars and knuckle heads to enable them to go around sharp curves. It is the intention to haul one, and possibly two, of these in a train, and to make through shipments over other roads.

The forms used in handling freight follow closely steam freight practice. The agent makes waybills in duplicate in a book. A receipt goes to the consignee, a tissue copy of the bill goes to each line on interline business, and another copy goes with the package. The original remains in the book. Interline waybills show the routes and roads, and there are spaces showing time of receipt and departure to be signed by agents at junction points, with another space for receipt of final destination. All bills of lading as received are stamped with a rubber stamp, as follows: "Accepted, subject to all terms and conditions of the bills of lading of Dayton & Troy Electric Railway, per —— agent." This relieves the company of any unusual conditions which are placed in bills of lading by shippers. Local waybills are yellow, and interline, pink. Agents also have damage and adjustment reports (purple), shortage and adjustment reports (light green), over and adjustment reports (light red). They forward to headquarters a daily abstract of waybills forwarded and received; daily station balance debit and credit; a memorandum of waybills, passing through his office, on a brown card, and a daily expense bill. An apportionment book is kept showing the date, number, from, to, consignor, consignee, weight, freight, advances, prepaid, and names of roads with which interline business is done, showing their apportionment, debits and credits. Settlements between roads are made monthly.

As the system has only been in operation a few months, the management is unable to determine accurately what it costs to operate the freight business or what the average receipts are likely to be, but it is claimed that the proposition is much more satisfactory than the old express arrangements, the gross receipts for last month being 210 per cent greater for that department. The average receipts are about 5 cents per ton mile, and cars frequently earn 50 cents per car mile. The average operating expense for all cars at present is 12½ cents per car mile, the freight cars costing about the same as passengers, so far as can be determined.

The gross earnings of the property have shown an increase of 35 per cent since the institution of freight and interline passenger business.

The operating officers of the company are: Harrie P. Clegg, president and general manager; C. M. Paxton, secretary and traffic manager; W. E. Rolston, general superintendent and chief engineer; R. A. Crume, purchasing agent, and C. H. Murline, auditor.

TWO-MOTOR VS. FOUR-MOTOR TEST MADE BY THE UNITED RAILWAYS AND ELECTRIC COMPANY OF BALTIMORE

Through the courtesy of H. H. Adams, superintendent of shops of the United Railways & Electric Company, of Baltimore, the following data are presented giving a summary of a recent test carried out in Baltimore to determine the relative power consumption of two-motor and four-motor equipments. In each instance the tests extended over two days and were made not so much to establish the theoretical relative economy under ideal conditions, but to determine the relative power consumption of the two types of equipment as operated regularly in Baltimore.

Car No. 710 had a 31-ft. body mounted on double trucks with 33-in. wheels and was equipped with four Westinghouse 101-B motors, giving a total of 160 hp in motors to the car. This car complete weighed 45,000 lbs. light and had a seating capacity for forty-four passengers.

Car No. 730 had the same length body on maximum-traction trucks with 33-in. driving wheels, and was equipped with two Westinghouse 56 motors, giving a total of 110 hp. This car weighed 31,700 lbs. light and had a seating capacity for forty-six passengers.

From the summaries herewith printed it will be observed that under practically the same running conditions as regards line speed, gear ratio, seating capacity, number of stops and passengers carried, the four-motor equipment consumes but 10 per cent more current per car mile than the two-motor equipment. The two-motor car was equipped with hand brakes only, while the four-motor was fitted with air brakes, and it is possible that the current consumed by the two-motor equipment was slightly increased by reason of the motorman running with the hand brakes partly set in order to enable him to make his stops quickly. It is also probable that the two motors on car 730 were working at a disadvantage in that they were not altogether heavy enough for the service. The same motormen were used upon corresponding trips in each test.

	Car No. 710	Relative Percentage	Car No. 730	Relative Percentage
Type of equipment	4 W. 101-B motors		2 W No. 56 motors	
Horse-power	160 hp total	100%	110 hp total	68.7%
Gear ratio	18-66 or 1:3.66	100%	18-64 or 1:3.56	.97%
Weight	45,000 lbs.	100%	31,700 lbs.	70.5%
Average kw	28.47	100%	25.65	90.%
Average amperes (assuming voltage 500)	56.95	100%	50.6	90.%
Kw-hour per car mile	3.525	100%	3.17	90.%
Kw-hour per ton mile	.1565	100%	.200	128.%
Average passengers carried per round trip	145	100%	148	102 %

QUICK WORK IN EQUIPPING CARS AT BALTIMORE

The United Railways & Electric Company is now receiving the last of an order of 200 cars of the Brill semi-convertible type. Of this order, 160 cars are 30 ft. 8 ins. over corner posts with 5 ft. platforms, for city service, and the remaining forty are the same length over posts but with platforms 5 ft. 6 ins. for high speed service. Heretofore, the Baltimore system has been committed to maximum traction trucks as the wide track gage, which is 5 ft. 4½ ins., and the narrow streets did not permit of an ordinary double truck car. However, by very careful designing and the adoption of a straight-sided car, a double-truck car has been developed that operates satisfactorily on the streets in Baltimore, and all the rolling stock on the shipment now being received will have double trucks with eight 33-in. wheels and four motors on each car. Of the electrical equipments, 160 are GE-80 motors rated at 40 hp each and forty are GE-90 motors rated at 55 hp each. The controllers are of a comparatively new type designated as K 28 F, with a new device embodying two contactors in series with the controller placed underneath the car so that the heaviest portion of the current is broken below the car, instead of in the controller case.

The forty cars for high-speed service are fitted with rolled-steel wheels, and are equipped with air brakes.

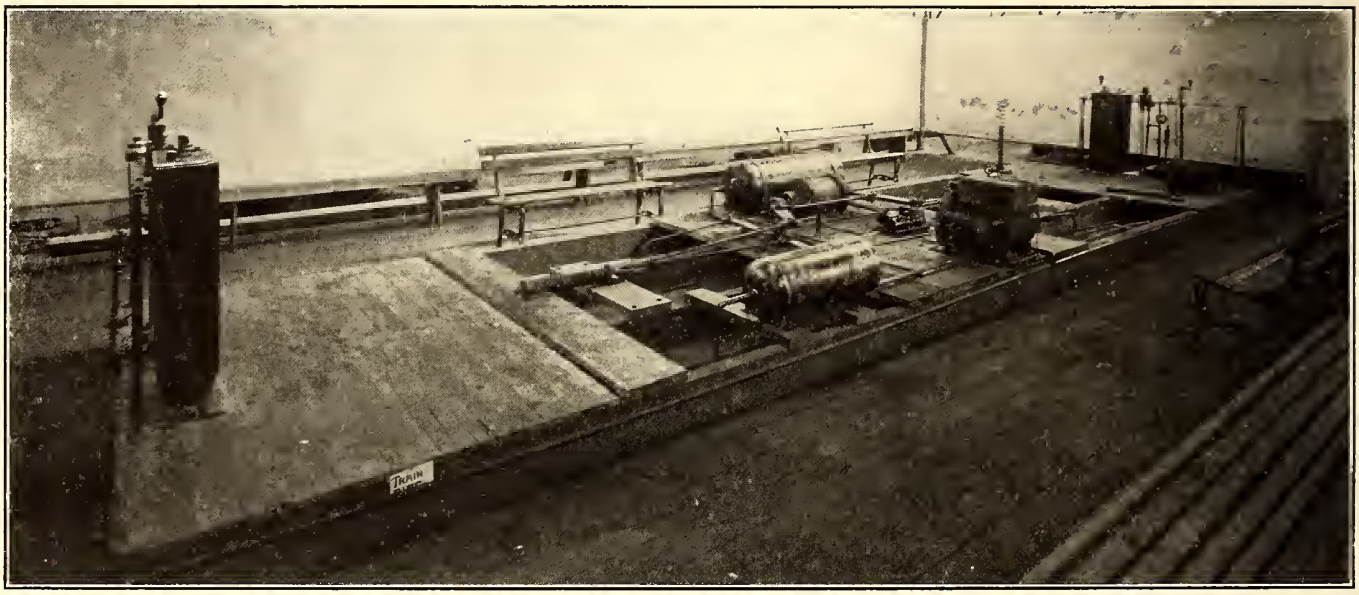
In equipping these cars at the shops of the railway company it is believed that a new record has been established for quick work. The bodies as received from the manufacturers had practically none of the auxiliary equipment, and the work of installing air brakes, wiring trucks, motors, etc., was done at the Carroll Park Shops of the railway company. After this work was once under way the cars were turned out at the rate of five per day complete. H. H. Adams, superintendent of rolling stock, states this was accomplished by carefully systematizing the work and perfecting an organization for this one purpose. In the beginning one car was equipped complete, and all the parts were then taken down and used as templates and patterns for making up the parts used on all the rest of the cars. For instance, on the air brake equiqments all the pipes were bent to shape, accurately fitted and assembled so far as possible before being placed on the cars, two men being engaged on this work, so that all the materials were ready in advance for the car men, and all that the latter had to do was to place the parts in position underneath the car. Only the best of materials were used in the air brake parts, all pipe being galvanized iron with brass unions, and each piece of pipe was reamed and blown out with steam jet before being installed.

The force for equipping cars was organized as follows:

Mounting motors, etc., ten men.
Electrical work, twenty men.
Trucks, sand boxes and brakes, ten men.
Boring and carpenter work, three men.
Air equipment, piping, etc., ten men.

This gives a total of fifty-three men, including two men working upon the bending of pipes, etc., and this force was able to turn out complete five cars per day of ten hours.

As these were the first cars on which air brakes had been used, arrangements were made for thoroughly instructing the motormen in the use of the equipment, and for this purpose Mr. Adams rigged up a platform in one corner of the shops to represent the bottom of a car turned upside down. On this platform were installed a complete air brake and control apparatus, so that all the details could be readily explained to the car crews. All the parts of the apparatus were labelled with their proper names as a means of familiarizing the men with the air brake terms.



AIR-BRAKE EQUIPMENT MOUNTED ON PLATFORM FOR INSTRUCTING EMPLOYEES AT SHOPS OF THE UNITED RAILWAYS & ELECTRIC COMPANY, OF BALTIMORE

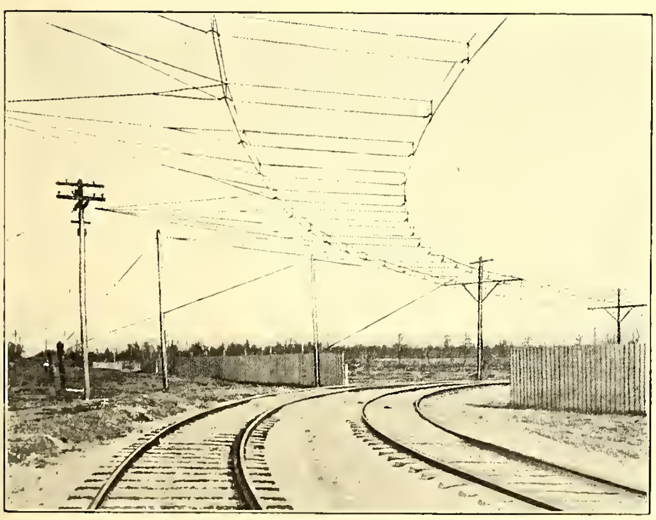
D. C. CATENARY AT NEW ORLEANS

The New Orleans Railways Company last year built an extension to the new City Park race track, and took the occasion to install catenary construction as a sort of experiment, with the idea of determining just what can be expected from the catenary in ordinary service. The extension is operated entirely by direct current, so the experiment is being made not so much with reference to the question of insulation, as to determine what the mechanical and operating results will be, and particularly to find out whether the number of overhead troubles can be reduced by this method of construction. The line has been up for only a short time, but the results, so far, have been thoroughly satisfactory, and seem to indicate that the troubles caused by trolley wheels leaving the wire and breaking down the overhead work can be virtually eliminated.

The line was built from the company's own plans in accordance with the ideas of A. L. Black, electrical engineer for the company. The catenary is supported on creosoted wooden poles spaced 100 ft. apart. It is believed a considerably greater spacing would be entirely safe with catenary suspension, and if the poles are placed every 150 ft. or 175 ft. apart, it is believed catenary suspension can be constructed at but little additional cost over the cost of ordinary trolley construction, inasmuch as the saving in poles, brackets and overhead material will very nearly counterbalance the additional cost of the catenary.

DIRECT-CURRENT CATENARY AT NEW ORLEANS

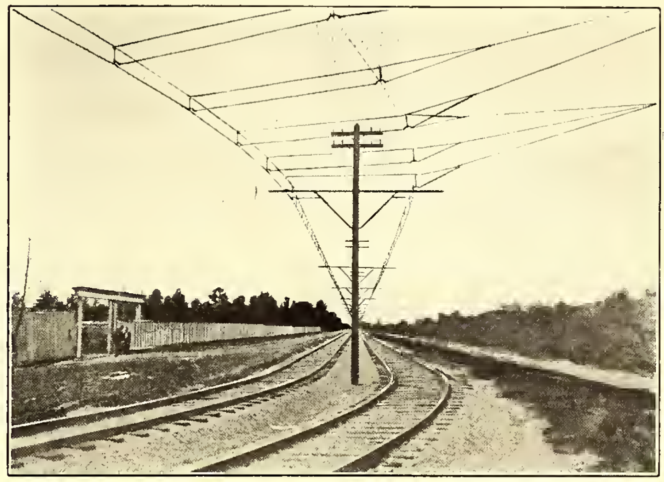
The messenger wire from which is suspended the trolley, is a ½-in. galvanized steel strand wire, which is supported by 10-ft. steel tube brackets attached to the poles by regulation wall sockets. The messenger wire is attached to the pole brackets by means of a Locke insulator, which is held in place on the brackets by a special iron casting.



VIEW SHOWING CONSTRUCTION OF DIRECT-CURRENT CATENARY ON CURVES

The trolley is 0000 grooved wire, and it is suspended from the messenger wire by spreaders of ½-in. pipe in varying lengths, depending on the catenary curve. These spreaders are attached to the messenger wire by three-prong clamps, and to the trolley wire by 4-in. mechanical clips, the spreaders being provided at both ends with screw threads to screw into the clamp and clip, respectively. The overhead material was supplied by the Ohio Brass Company.

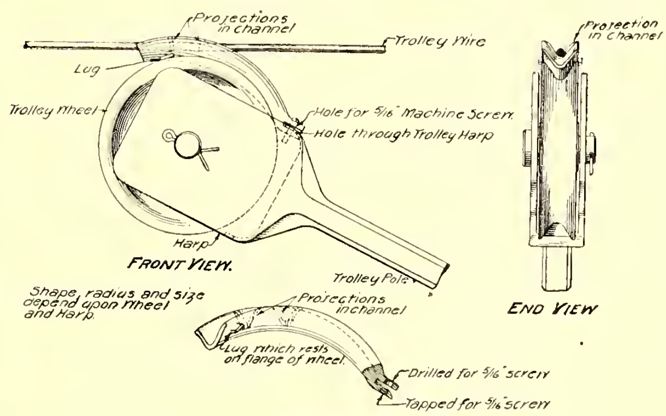
At curves, the construction is held in place by single and double pull-offs attached to both the messenger wire and the trolley wire. The pull-offs from the two wires in each case meet in a common pull-off insulator, from which they are carried to the guy pole by a single guy wire. At the beginning of curves, the construction is further strengthened by means of an iron rod reaching from the bracket brace on the pole out to the trolley wire to which it is attached by a standard clip. The photographs will serve to illustrate the appearance of the construction.



VIEW SHOWING CONSTRUCTION OF DIRECT-CURRENT CATENARY ON CURVES

SLEET CUTTER

J. L. Sullivan, master mechanic of the St. Francis County Railway Company, of Farmington, Mo., sends the following description and sketch of a device for removing sleet from the trolley wire. The device is a small casting shaped something like the section of the rim of a trolley wheel, and is designed to be attached to the harp so that it will cover the upper part of the wheel, and the trolley wire, instead of engaging the regular groove of the wheel, bears against this auxiliary rim. The groove of the attachment is fitted with



DETAILS OF SLEET-CUTTING DEVICE

projections which scrape against the wire and break up the ice or sleet. The device is made of composition of about the same hardness as the trolley wheel, and is attached to the harp by means of a 5-16-in. screw.

As a result of the franchise granted to the Chicago & Milwaukee Electric Railway Company for entrance into Milwaukee, it is said the company will four-track its line so as to give limited service between Chicago and Milwaukee.

NOTES FROM HOUSTON, TEXAS

Houston is a progressive, growing, go-ahead city with a population of 60,000, and by reason of its railroad and water connections is rapidly becoming one of the foremost cities in the Southwest. The Houston Electric Company, which operates all the street railway lines in the city of Houston, has passed through some troublous times, including a boycott and strike during the latter part of 1904. But under the management of Stone & Webster, of Boston, who now control the company, the property has been greatly improved, additional lines have been built, and the enterprise bids fair to have an entirely satisfactory and successful future.

The street railway system comprises 42 miles of track. Owing to the saturated condition of the soil it is difficult to obtain a good foundation for track work, and most of the track recently laid is built with a layer of planking underneath the ties in a manner which will be described in detail in a later issue of the Street Railway Journal.

The road is distinctly a city system, as only two of the lines extend into the suburbs, and these are but four or five miles long. The company has recently adopted as its standard type of car a car body measuring 44 ft. 8 ins., built by the St. Louis Car Company, and mounted on Brill No. 27-G trucks with two GE-67 motors to the car, both motors being mounted on the rear truck. The cars are fitted with the Detroit divided platform, and are equipped with Christensen air brakes. They are provided with the United States combined arc and incandescent headlight. There are practically no grades on the system, and the speeds are not high, and for this service this type of car has been found thoroughly satisfactory.

In mounting the car body on the trucks, the center of the body is set about 13 ins. forward of the center line of the trucks. The purpose of this is to throw the dead weight of the car forward, inasmuch as the cars are operated only from one end, and the live load is usually thrown largely on the rear truck due to the natural reluctance of passengers to move forward in the car.

The company is using a chilled-iron wheel made by the Dickson Car Wheel Company, of Houston, and is getting an average of 35,000 miles to 40,000 miles from these wheels. The standard wheel weighs 450 lbs., is 33 ins. in diameter, with 2¼-in. tread, and ⅞-in. flange. The axle is cold rolled steel, 4 ins. in diameter. It is the practice to press wheels on axles with 30 tons to 35 tons pressure. The company is now using split gears of the Nuttall make.

The trucks are all fitted with soft gray iron brake-shoes without chill, made in a local foundry. The brake rigging is the standard rigging furnished by the truck manufacturers with this type of truck. The braking leverage is arranged to equalize on all eight wheels, but it is the practice to set the shoes on the rear truck a little closer to the wheels so the driving wheels receive considerably more of the braking effort.

Babbitt linings are used in all armature motor and axle bearings. The company is still using a high grade grease for bearing lubrication, but is watching with interest for the development of a feeding device that will permit of oil lubrication. On axle bearings it is the practice to pour the babbitt lining to size without boring. Armature bearings, however, are bored out on a lathe to an exact fit.

The company repairs and winds its armatures in its own shops, and makes part of its own coils. The master mechanic is of the opinion that it does not pay a small company to attempt to make all of its own armature coils. It is difficult to say just where the line can be drawn in this regard, but the road must be large enough to warrant the organization of a coil department equipped with modern machinery. Where a small road has several types of motors in use, it will take a considerable force in the armature department to keep sufficient of the different types of coils on hand, and the number of damaged armatures varies so largely, depending upon weather conditions, that at times the coil department will have little to do while at other times extra men will have to be added to the force to keep up with the demand. To secure any economy in making its own coils, therefore, the company must be large enough to keep a well organized force of winders busy all the time.

The power station of the company contains one 650-kw General Electric 550-600 volt railway generator direct connected to a Hamilton-Corliss cross-compound engine. This machinery was installed in 1904, and is now used to carry the load for the greater part of the day. In addition to this unit there is also some older generating equipment comprising one 250-kw General Electric generator, one 225-kw Westinghouse generator, two Edison 80-kw machines and two Thomson-Houston 80-kw multi-polar machines, all belted to a jack-shaft driven by two Allis cross-compound condensing engines. The station output ranges during the day from 600 kw to 800 kw, and this load is well taken care of by the 650-kw unit. At night the load drops to about 300 kw, and it is the custom to then shut down the main unit and supply current from the older apparatus. The station is showing excellent economy in cost per unit of output, and this arrangement of having one unit of sufficient size to carry the day load, including the morning and evening peaks, with a relay of smaller units for the night load, appears to be an excellent plan.

STREET BOOTH FOR STARTER AND INSPECTOR, HOUSTON

The station is burning Texas oil exclusively, as fuel under the boilers, and it has been found a clean, convenient and economical substitute for coal. A feature of the station is the small amount of lost heat radiated from the front of the boilers into the boiler room. In fact, during a recent cold snap it was found necessary to keep a fire going in a small stove in the boiler room in order to provide warmth for the boiler-room attendants, although the boilers were working at overload pressure.

The company is now building a complete new storage house and shop plant, and as soon as the plans are perfected they will be published in the Street Railway Journal.

The following is the personnel of the local operating organization acting for Stone & Webster, of Boston: Manager, David Daly; superintendent, W. H. Tucker; engineer of power station, John F. Usener; electrical engineer, F. D. Martinez; master mechanic, V. W. Berry.

CONTACTORS WITH A SERIES PARALLEL CONTEROLLR

The United Railways & Electric Company, of Baltimore, has recently installed on a number of its long four-motor cars, the K-28-D controller, in which two contactors in series are used to break the main circuit. This controller has recently been brought out by the General Electric Company, and is intended to obviate the objections to the use of the ordinary series parallel controller with four-motor equipments. The troubles resulting when the main circuit is broken inside of the controller casing, were discussed at the Philadelphia meeting of the American Street and Interurban Railway Engineering Association, and several editorials have been published in this paper on temporary expedients, such as the manipulation of the circuit breaker, by which these troubles can be reduced.

Fig. 1 illustrates the wiring diagram of the K-28-D controller system. The two contactors for breaking the circuit are used in conjunction with two small contacts in the controller casing and just below the controller cylinder. These contacts are illustrated in Fig. 2, and are used for completing the circuit through the operating coils of the contactors.

A pivot arm, operated by a projection on the fibre disc at the bottom of the cylinder, brings the two fingers into contact with a cross-connecting strip. A magnetic blow-out is used for promptly extinguishing the arc occasioned at the fingers of this switch when opening the circuit. The projection in the fibre disc is so located that the contactor circuit is completed after the main fingers have made contact with the cylinder segments, and it is intended that in turning off the two contactors shall open the circuit slightly in advance of the main fingers, thereby taking most of the burning.

The K-28 controller is perfectly able to handle the ordinary arcing occasioned in opening the circuit, but in case a motor becomes damaged and the arcing at the fingers is greatly increased, the contactors insure a prompt extinguishing of the arc. As the contactors are placed in the main circuit between the controller and trolley, they prevent an arc from holding between the trolley finger and any grounded portion of the controller after the controller has been turned to its off position. The two contactors, operating with the resistance tubes which are placed in series with the operating coils, are mounted in an iron box which is located in a convenient position under the car.

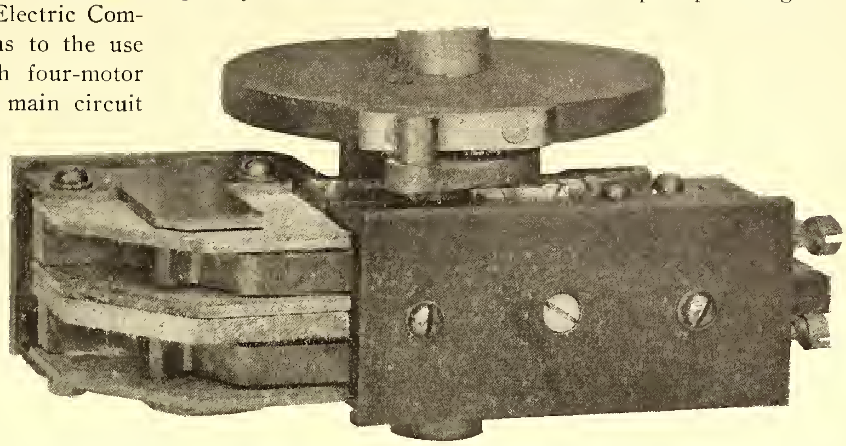


FIG. 2.—FINGERS AT BASE OF CONTROLLER FOR OPERATING CONTACTORS

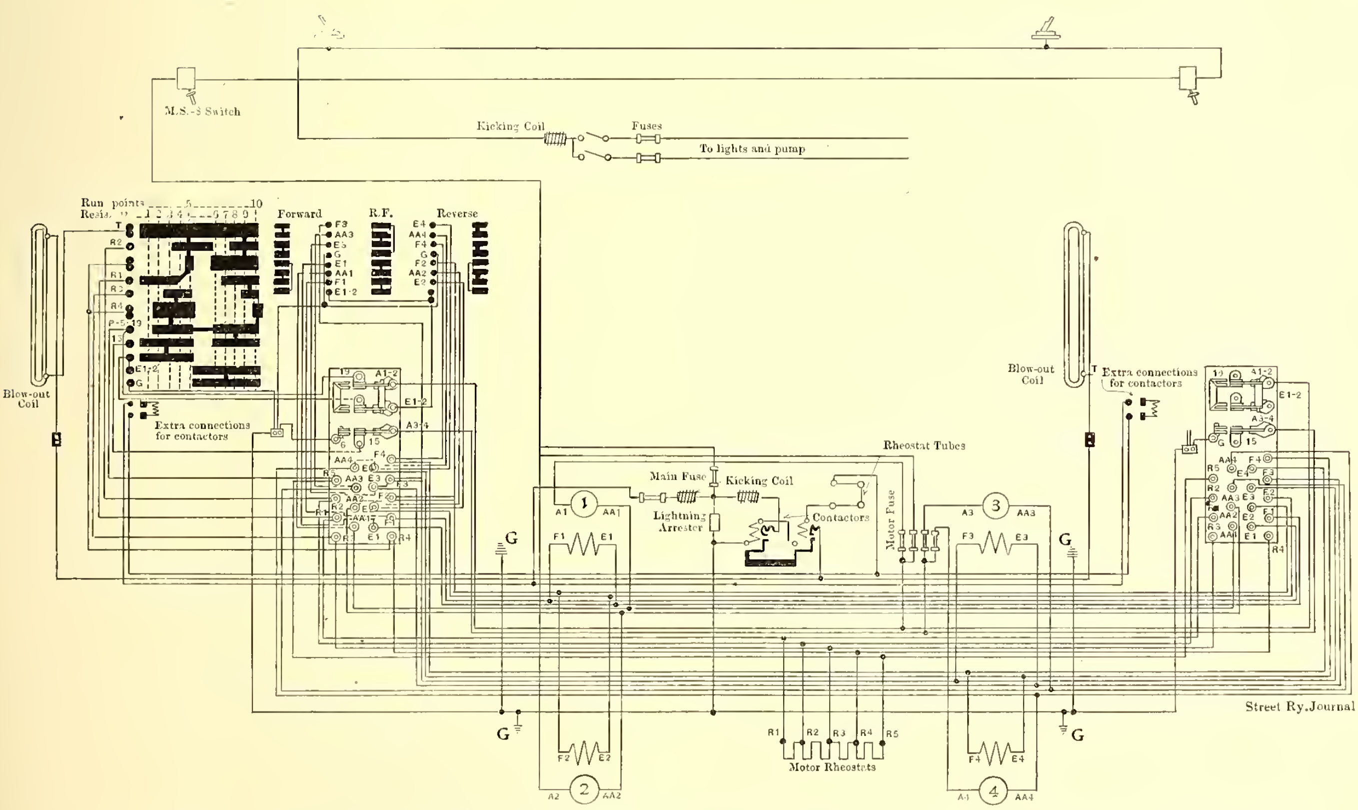


FIG. 1.—WIRING DIAGRAM OF K-28 CONTROLLER SYSTEM EMBRACING TWO CONTACTORS AS USED ON FOUR-MOTOR EQUIPMENTS IN BALTIMORE

The Worcester & Northern Railway Company has been granted a charter for an electric railway from Holden to Princeton, Mass.

PROPOSED INTERURBANS IN MICHIGAN

While it was at Detroit that the first interurban railway development in Michigan occurred, other cities throughout the State were slow to profit by her experience. Excellent city and suburban lines were built, but here development seemed for a time to rest. Recently, however, a number of important lines have been built, and the prospects for new construction during the coming year are better than ever before. In fact, the plans in hand for building new lines exceed in number and are more pretentious than ever, as the accompanying map shows. A summary of these projects follows:

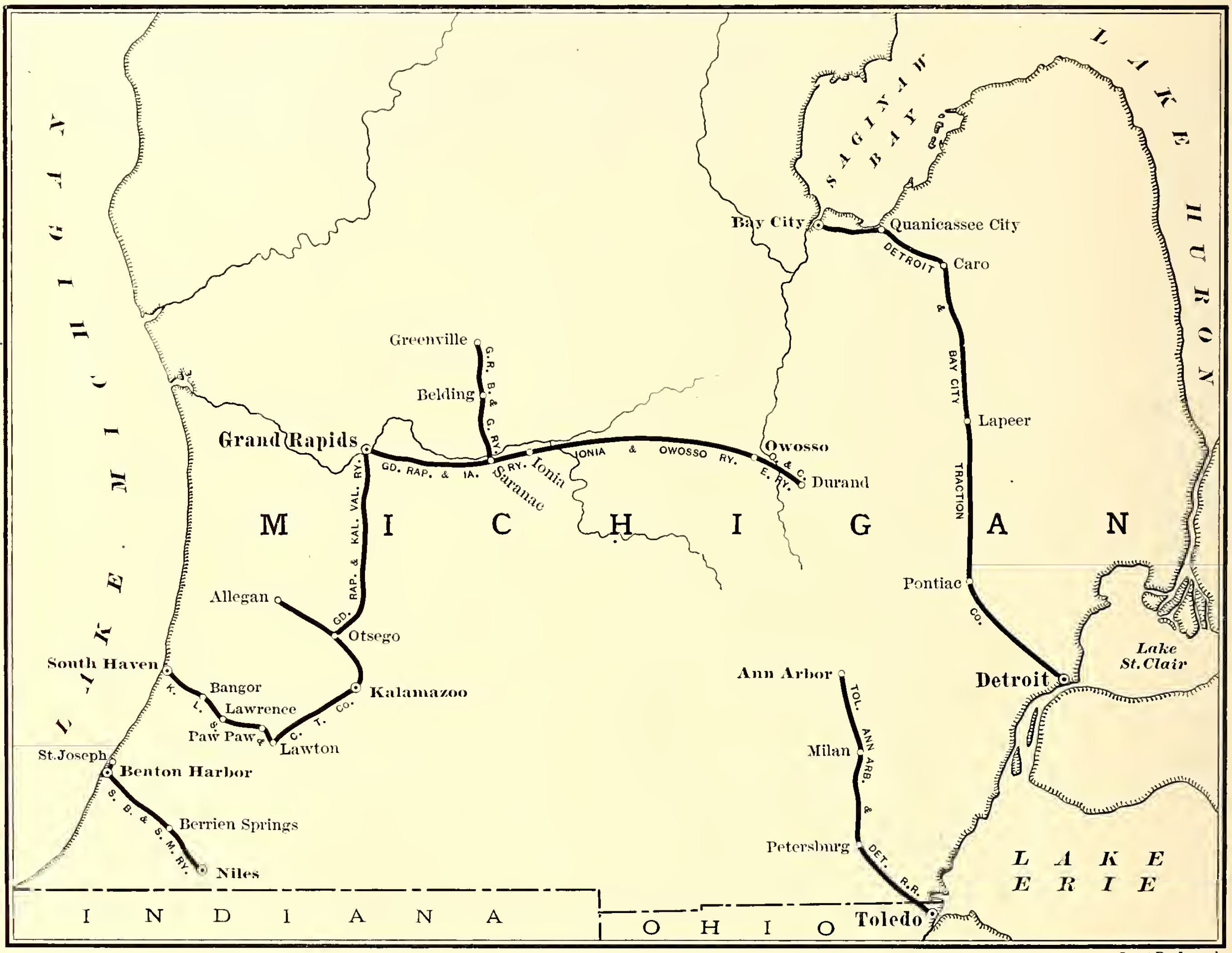
The Detroit-Bay City Traction Company has commenced work on its line, which it is believed will add an important feeder to the growth of Detroit. Grading has been commenced between Bay City and Quanicasse City, and the right of way through to Detroit is said to have been all secured.

The Grand Rapids & Ionia, the Grand Rapids, Belding & Greenville and the Ionia & Owosso lines are part of the interurban system which ex-Governors John T. Rich and A. T. Bliss and their associates plan to construct. The Lansing-Jackson line is to be a part of the Mills-Elliott-Moore system, for which it is proposed to make Lansing the center. The roadbed for the lines has been constructed to Mason, with the exception of a few short stretches, and all of the right of way has been secured. The company has the material and expects to renew construction of the line early the coming spring.

The same company is also planning to extend its line, which is completed to Pine Lake, north to Owosso, and some of the right of way and other details have been completed for that road.

West from Lansing to Grand Ledge, a line is projected by the Platt Power & Heating Company, of Lansing. The company has secured a number of water power rights along Grand River, and as soon as the stations are established it proposes to construct the road.

The Kalamazoo, Lake Shore & Chicago Traction Company has purchased of the Michigan Central that stretch of track between Kalamazoo and Mattawan, which the steam road abandoned when it straightened its main line. The traction expects to have its cars running early in the year to South Haven, with steam motive power, and later with electric power. It is understood that it is this system with which the Mills-Elliott-Moore syndicate expects to connect its Jackson-Kalamazoo line for traffic through to Chicago.



MAP SHOWING SOME LONG ELECTRIC INTERURBAN LINES PROPOSED IN LOWER MICHIGAN

The St. Joe River Traction Company proposes to construct a line from St. Joseph to Dowagiac, and has made application for crossings over the Pere Marquette, near St. Joseph, and over the Big Four at Eau Claire.

The line from Benton Harbor to Niles is one that the South Bend & Southern Michigan Railway proposes to build as the beginning of a line through to South Bend.

Recently there have been articles filed by a company known as the Kalamazoo-South Bend Traction Company, but nothing is known as to its plans.

The Detroit, Ann Arbor & Toledo line is one that John

O. Zabel, of Petersburg, is promoting, and it is said that some work has been done on that line.

The line from Owosso to Durand is planned as an extension of the present interurban line between Owosso and Corunna, and the company has secured some right of way and franchises for it.

DISCUSSION ON AXLES AT THE NEW ENGLAND STREET RAILWAY CLUB

The second meeting of the New England Street Railway Club this year was held in Boston at the American House, on the evening of March 1, President E. E. Potter, of New Bedford, being in the chair. After the usual dinner a short business meeting was held, and it was announced that the club's annual meeting and banquet would be held in Boston on March 22, the banquet being assigned at the Hotel Somerset. The speaker of the evening at the American House was E. T. Millar, general car foreman of the Boston & Maine Railroad. His subject was "Axles."

At the outset of his address, Mr. Millar emphasized the importance of the axle question as regards design, quality of material and methods of manufacture. Axles as used on steam and electric roads are practically known as two classes—the Muley or buttonless journal, and the M. C. B. type, or button journal. The M. C. B. standard axle has journals 3¾ in. by 7 in., with a 5⅛ in. wheel fit. The Muley axle has several serious disadvantages. It is sometimes called the "end thrust" axle, referring not only to a piece of metal which comes in contact with the end of the axle, but to an axle which has a piece of metal which slides down into a groove cut in the end of the axle. With these types of bearing, inspection is difficult, for the piece of metal must be removed in order to see just what the condition of the bearing is. The number of spare parts to be carried in stock is unduly increased, lubrication is not apt to be well applied, and end play is often excessive on account of the wear of the metal, which takes the end thrust with the M. C. B. bearing. As the end wear occurs the journal also wears down in thickness, and eventually has to be renewed.

Axle specifications are necessary for safety and economy, and there is no more important part of a car than the axle, for the reasons that breakages are very dangerous, and overheating causes delays in the handling of traffic. It is generally admitted that steel made in open-hearth furnaces is much superior to that made by the Bessemer converter process, for the former seems to withstand shocks better. The M. C. B. steel-axle specifications call for .40 per cent; manganese, not over .50 per cent; silicon, .05 per cent, sulphur .04 per cent, and phosporus, not over .05 per cent. Mr. Millar emphasized the fact that the last named is the dangerous element, and recommended a tensile strength of 80,000 lbs. per sq. in., elastic limit, 40,000 lbs. Axles should be free from flaws, and journals turned smooth and cold-rolled before being placed in operation.

The cars on the Boston & Maine's electric line at Concord, N. H., weigh about 20 tons light when ready for service, and are equipped with 3¼-in. by 6-in. journals. When the journals are worn down to 3 ins., they are scrapped. A taper of 1-32 in. between the front and back end of an axle means truing up as though the axle were new. In milling key seats for gears, fillets should be used at the ends so as to avoid sharp corners.

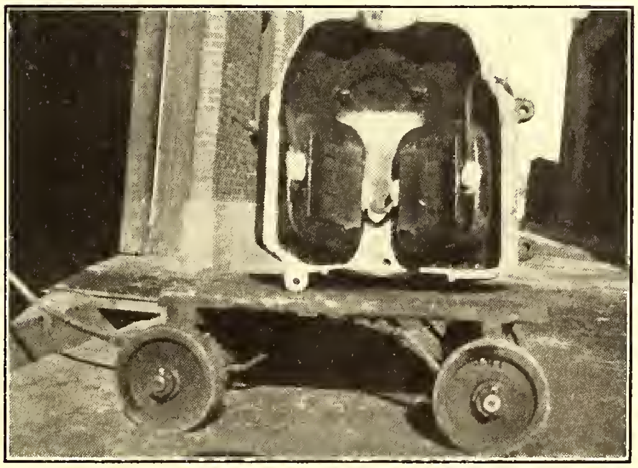
Mr. Millar stated that he had always maintained that the condition of the track on the electric line at Concord should receive as much credit in the elimination of broken axles as the design, material and workmanship of the axles themselves. When the public, who patronize this line, feel that the company has given them as good a car and as easy riding one as could be expected, there is little doubt that the track man is largely responsible for the smoothing down of rough places.

In the brief discussion which followed the presentation of the address, it was stated that one great trouble of the axle question was that companies are not willing to pay the cost of specifying much better axles than are commonly used at present. Axles can be obtained of over 200,000 lbs. tensile strength, with 22 per cent or 23 per cent elongation in test pieces, instead of 18 per cent. Automobile axles represent a very high development in point of strength. The axles of electric cars are subject to strains of the order of those encountered in locomotive-driving axles, rather than in the axles of trail cars. Less than .03 per cent phosphorus can now be obtained in commercial products. The treatment of the steel is the most important subject of all. Chrome-nickel steel is growing in favor in Europe, and will doubtless be successfully used in this country before a great while. The meeting closed with a rising vote of thanks to the speaker.

PROTECTING RAILWAY MOTOR FIELD TERMINALS

An effective and original method to prevent the burning out of fields, due to flashing at the terminals on account of the accumulation of carbon and copper dust, is being followed with success by the Colorado Springs & Interurban Railway Company, of Colorado Springs, Colo. This method originated about a year ago with B. M. Lathrop, superintendent of the company, and since its adoption has prevented the loss of a single field by lightning or otherwise.

It consists first of making a mixture in equal parts of



PROTECTING THE LOWER FIELD TERMINALS OF A G E NO. 67 MOTOR

shredded asbestos, shellac and plaster of paris, which, when properly introduced and kneaded, forms a pulp about equal in consistency to putty. The terminal posts and cables are then thoroughly cleaned and fastened, and the mixture applied so that it completely covers from view the entire connection.

The shreds of the asbestos then serve to bind and hold the mixture together in drying after application. After being applied and subjected to the air for about twenty-four hours, this mixture hardens by reason of the presence of the plaster of paris and shellac, and with the asbestos forms a very tough and solid material. It can be removed, if necessary, only by being broken by severe hammering.

CORRESPONDENCE

LARGE ELECTRIC AND STEAM LOCOMOTIVES

THE BALTIMORE & OHIO RAILROAD COMPANY

Baltimore, Md., March 3, 1906.

EDITORS STREET RAILWAY JOURNAL:

Having observed the remarks under the caption "Two Papers on Heavy Electric Traction," in your publication of Feb. 24, I take pleasure in reviewing, for the information of your readers, the following items relating to the paper presented before the New York Railroad Club.

The report was based on observations and results obtained from actual practical performance covering a sufficient period to warrant the conclusions reached, and the opinions expressed were fully justified and strictly unbiased. A comparison was made between electric locomotives completed by the designers and builders in September, 1903, and a steam locomotive, the construction of which was finished eight months later.

While the electric locomotives were operated in helper service over the extremely short maximum distance of 3.4 miles, about 1⅜ miles of which is a continuous tunnel, with ⅝ miles made up of six short tunnels and masonry bridges, there still remained 1.4 miles in the open; the steam locomotive was run in helper service for a maximum distance of 16.5 miles, and in through freight service for a distance of 43.5 miles. On the mountain division, where the steam locomotive was in service, the conditions with respect to snow, sleet, dampness, slippery rail and wind were much more severe than on the better protected line traversed by the electric locomotives.

The work done by the electric locomotives, composed of two sections, consisted of hauling trains averaging 1100 tons for 3.4 miles over a ruling gradient of 1.5 per cent, with curvature of from 5 degs. to 11 degs. The work done by the steam locomotive consisted of pushing an average of 1950 tons of train for 14 miles, over a ruling gradient of 1 per cent, with curvature of from 1 deg. 30' to 7 degs. The comparative conditions and distances, therefore, show most favorably for the economical operation of the electric locomotive motors, and the tunnel conditions were not such as to be prohibitive to a high power-plant efficiency.

In compiling the specifications for a modern electric locomotive, the first, second, fourth, fifth, sixth, seventh, eighth, tenth and eleventh requirements can all be met by certain types of modern steam locomotives. The third requirement is necessary in electric but not in steam locomotives, for the reason that the former cannot be economically constructed nor operated in as large single units as steam locomotives, and in order to produce the hauling capacity it is necessary that the sections shall be constructed in a manner that will prevent delay and expense for coupling up and operating. The ninth, twelfth and fourteenth requirements are not applicable to steam locomotives, but from practical experience they are most essential for electric locomotive operation. The thirteenth specification is a proposition that has been brought out by some electric locomotive advocates as a strong reason for the adoption of electric traction for the handling of traffic over mountainous lines.

The additional essential requirements that can be met in the steam, but which were omitted from the electric locomotives, are as follows:

(1) A minimum capital and maintenance cost per unit of tractive power.

(2) A self-contained machine generating the power necessary to develop its hauling capacity.

(3) The smallest number of bearings and parts per unit of power developed.

As to the specification for the elimination of armatures from locomotive driver-wheel axles, and the transmission of power to driver wheels not less than 60 ins. initial diameter, without the use of gearing, this was accomplished in quite a simple and satisfactory manner, in connection with electric locomotives weighing 196,000 lbs. that were constructed ten years ago, and which have been in service ever since that time. Such a method of power transmission was also provided on two types of electric locomotives, illustrated and described in your issue of Feb. 24, 1906.

The cost of $6.10 per 100 miles run for running and shop repairs made for one year, per electric locomotive consisting of one section, must be approximately doubled to compare it with the cost of $5.14 per 100 miles run, which was the cost for the combined running and shop repairs for the steam locomotive on account of work performed during the same period. The charge of 9 cents per mile was an estimated figure covering a future ten years' performance of the steam locomotive, and cannot be applied as comparative with the one to two years old electric locomotive present costs.

As regards power house performance, so long as the current required is supplied in sufficient quantity and charged at a cost per kw-hour approximating the performance of up-to-date power plants using coal for fuel, there can be no severe criticism.

In justice to the expressions as given in the report, as well as to both the electric and steam locomotive performance in question, I have thought that the above information should be given to avoid any misapprehension in connection with the factors involved. J. E. MUHLFELD,

General Superintendent of Motive Power.

NEWTON & NORTHWESTERN ELECTRIFICATION IN IOWA

The owners of the Newton & Northwestern Railway Company, who have recently devised plans to electrify a portion of the main line and construct extensions from a point near Boxholm to Fort Dodge and from Kelley to Des Moines, Ia., as noted heretofore in these columns, have organized another company, to be known as the Fort Dodge, Des Moines & Southern Railway Company, which will have charge of the construction of the two extensions, the electrification of the necessary parts of the main line, and the operation of the completed line between Des Moines and Fort Dodge and another extension from Kelley to Ames, and possibly to Nevada, Ia. Articles of incorporation of this company were filed in Iowa Feb. 27, 1906. Boone is made the principal place of business of the new company. The company organizes with a capitalization of $10,000, which will be used to carry on the preliminary surveys, and which will be increased from time to time as the necessity arises. The articles state that the business of the company shall be the acquisition by construction, purchase or lease of a railway or railways, connecting the city of Boone with the city of Des Moines, the city of Fort Dodge and the city of Ames, all in Iowa, and extending the same and the construction, purchasing or leasing of other railway lines in Iowa and operating said railways by steam, electricity or other practical motive power. The board of directors is composed of the following: W. H. Benn, C. E. Rice, W. Chamberlain and C. O. Elbert, addresses not given. These parties are also the incorporators. The engineers will be placed in the field this week to locate the proposed line from Kelley to Des Moines. The contract for the construction of the extension from Boxholm or Lanyon to Fort Dodge will be awarded within the next ten days, and work will then be started on that section.

TESTING LIGHTNING ARRESTERS

BY W. P. JACKSON,
Master Mechanic, Columbus, London & Springfield Railway

The subject of testing lightning arresters is of particular interest at this season of the year, and I submit below a method, which I believe to be of considerable value, inasmuch as, during one operation consuming about five minutes, it will indicate the existance of open circuits in either trolley or ground taps, measure the length of spark gap, and also indicate the existence of a defective blow-out coil, or a high-resistance graphite rod.

For testing car arresters, a resistance taking 4 amps. to 5 amps. on 550 volts is mounted in a suitable location in the car house. Attached thereto by a sufficient length of No. 14 insulated wire, is a hook fastened on the end of a light wooden pole, 8 ft. to 10 ft. in length. This, with a test gage of metal 1-40 in. thick x ½ in. wide x 3 ins. long, provided with an insulated handle, and a connection of 4 ft. of No. 14 insulated wire, constitutes the necessary apparatus.

When testing the arrester on a car, the trolley is first pulled down, and all paths for the current, such as lights, heaters, pump and headlight circuits, are cut off. The main motor switch or circuit breaker is left in. The circuit hook is then placed over the trolley wheel, the arrester box opened, and the gage is inserted in the spark gap and then withdrawn. If the gage goes in with a snug fit, the gap is of proper length. If, when the gage is taken out, it draws a fat arc, which is promptly extinguished, the inspector can safely assume that the trolley and ground connections, resistance rod and blow-out coil are in good condition. If no arc occurs, it indicates an open circuit in the trolley or ground taps. To determine which is at fault, the gage is re-inserted and one end of the connecting wire is touched to the rail or other convenient ground. If a spark is obtained, it is safe to assume that the ground tap is open-circuited. If no spark occurs, the open circuit should be looked for in trolley taps, or in the arrester itself.

If, when the gage is withdrawn, the arc is very weak, or a mere spark, the existence of a high-resistance graphite rod is indicated. A defective blow-out coil is readily detected by the failure of arc to rupture after the gage is withdrawn.

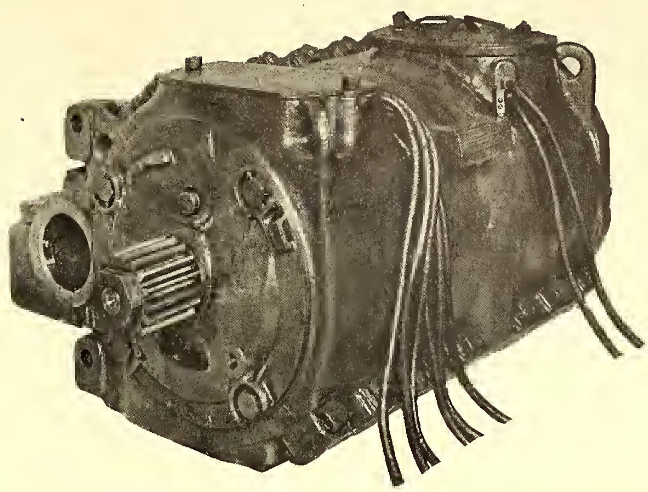
The same method of testing will serve for line arresters by mounting the resistance on the line car or speeder. In this case, the trolley taps should be opened, and resistance inserted in series with the arrester.

SINGLE-PHASE EXTENSION AT MILWAUKEE

A short account was published last week of the two proposed interurban extensions to the system of the Milwaukee Electric Railway & Light Company, upon the single-phase system. One of these is to be 20 miles in length, the other 16 miles in length. Both lines will be operated at a potential of 3300 volts, and, in addition, the motors are designed to run on the existing 7 miles of 550-volt direct trolley line between West Allis and Milwaukee.

Each of the ten cars, comprising the initial equipment for these roads, will be furnished with four General Electric 75-hp motors, of the type known as the GEA-605. This motor was described in the Street Railway Journal for May 6, 1905, at which time a diagrammatic outline of the motor was published. A photograph of the motor is reproduced herewith.

These equipments will in general be operated as single cars, but occasionally will be run in two-car trains. For train control the Sprague-General Electric multiple-unit system will be used, adapted for operation on alternating current. The transformer for use on these cars is of the oil-cooled type, and is wound for 3300 volts on the primary, with five different secondary taps for controlling the speed



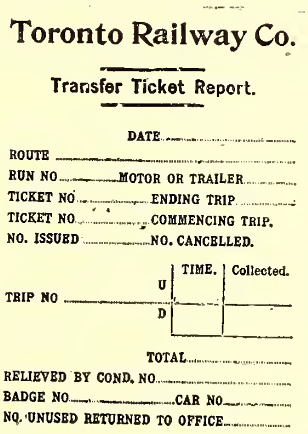
SINGLE-PHASE MOTOR FOR MILWAUKEE INTERURBAN LINES

of the motor. The speed regulation is so devised that the running speed will be the same on both the alternating and direct-current portions of the line.

Distribution of the various transformer sub-stations will be at 3300 volts. At the stations, the current will be fed to the trolley line at 3300 volts. The catenary construction will be used. It is proposed to have these extensions in operation during the fall of 1906.

THE HANDLING OF TRANSFERS IN CONNECTION WITH THE CANADIAN FARE SYSTEM

In response to various inquiries received from a number of railways in the United States, Robert J. Clark, of the Toronto Railway Company, has added to his paper on "Collecting and Handling Fares," published in the Street Railway Journal of Jan. 23, the following details regarding the company's methods of handling transfers.



Toronto Railway Co.

Transfer Ticket Report.

DATE
ROUTE
RUN NO .... MOTOR OR TRAILER
TICKET NO .... ENDING TRIP
TICKET NO .... COMMENCING TRIP.
NO. ISSUED .... NO. CANCELLED.

		TIME.	Collected.
TRIP NO	U		
	D		

TOTAL
RELIEVED BY COND. NO
BADGE NO .... CAR NO
NO. UNUSED RETURNED TO OFFICE

FACE OF ENVELOPE CONTAINING TRANSFERS

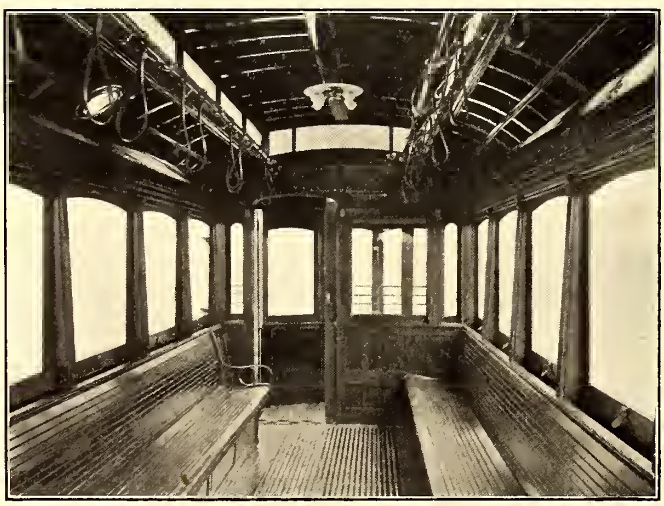
Owing to the collection of fares by the box system, the transfers have no monetary value, and consequently are not registered when collected They are collected by hand by the conductor and placed in envelopes designed for that purpose, as shown in the accompanying cut. On this he records the date, his badge number, the run number, the progressive number of the pad of transfers at starting trip, and the progressive number at conclusion of trip, the difference giving the number of tickets issued. At the end of the trip, he places the transfers collected in this envelope, indicates the number on the outside, seals the envelope and deposits the same in the nearest office as he passes on the next trip. These envelopes are then sorted at the office. A thorough check is made on one route per day, for which the controller's department checks up the number of transfer tickets issued to each individual conductor, the number issued by him to the public, and the number collected during the trip, strict scrutiny being made to see that the time indicated on the transfer ticket agrees with the time indicated for that particular trip on the envelope. When this is completed the issued or collected transfers are mutilated and placed in large bags and sold as scrap paper. The unissued tickets are retained to be issued as transfer extras on the same day in a later month should occasion require.

NEW EQUIPMENT FOR THE VINCENNES STREET RAILWAY

The car illustrated in the accompanying cut, is the standard type in use on the lines of the Vincennes Citizens' Street Railway Company. Several lots of these cars have

SINGLE-TRUCK CAR FOR VINCENNES CITIZENS' STREET RAILWAY

been furnished by the American Car Company, which is the builder of the present order. Vincennes, which is in the southwestern part of the State on the Wabash River, has now a population of over 10,000, and is of considerable importance as it is the junction of several steam railroad systems. The railway company operates about 10 miles of lines with upwards of twenty-five cars, and reaches Lincoln Park and the Fair Grounds, a short distance from the city, both of which are controlled by the company.

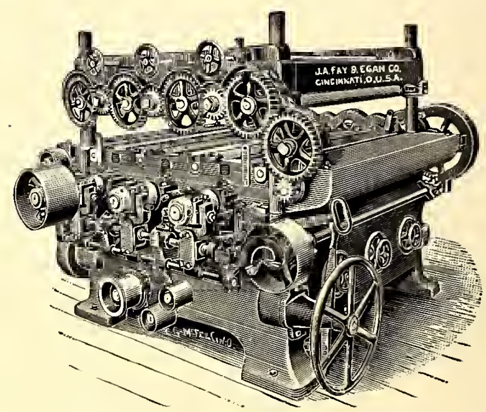


LONGITUDINAL SEATING AND SEMI-ACCELERATOR DOOR OF VINCENNES CAR

The cars are 18 ft. long over the bodies, and 27 ft. over the vestibules. The platforms, which are 4 ft. 6 ins. long, are enclosed at diagonally opposite corners of the car. The entrances are without doors or gates. Semi-accelerator doors are used on the body ends and in conjunction with the platform entrances at one side, aid considerably in facilitating egress and ingress. The width of the cars over the sills, including the panels are 6 ft. 3 ins., and over the posts at the belt, 7 ft. 6 ins.; the sweep of the posts is 8 ins., and the distance between the centers of the posts, 2 ft. 11 ins.; the height from the floor to the ceiling, 8 ft. $7\frac{1}{4}$ ins.; from the track to the under side of the sill, 2 ft. $2\frac{5}{8}$ ins., and from the under side of the sills over the trolley board, 9 ft. $1\frac{5}{8}$ ins.; from the track to the platform step, 14 ins., and from the step to the platform, 12 ins. The woodwork of the interiors consists of cherry, and the ceilings are of carline finish, all stained the same color. The longitudinally placed slat seats are also of cherry. The trucks are of the No. 21-E type with 7 ft. wheel base, 33-in. wheels and 4-in. axles. Two 25-hp motors are used per car. The weight of a car and truck without the motors, is 13,000 lbs.

TRIPLE-DRUM SANDER FOR RAILWAY SHOPS

The J. A. Fay & Egan Company, of Cincinnati, Ohio, recently brought out its No. 4 triple-drum sander, called "The Conqueror." It is stated that for car shops having fine sanding to do, this machine will be found very valuable, as the quality of its work is always first-class and uniform under the most trying conditions. It works material from 30 ins. to 80 ins. wide and 8 ins. thick. The three steel drums carry sandpaper of varying grade from coarse to fine, and have



TRIPLE-DRUM SANDING MACHINE

a vibratory motion that eliminates all lines and snake marks. These drums can be entirely removed without trouble, and any ordinary workman can recover them, and give the paper the proper tension in a very short time. There are eight feed rolls, four above and four below the platen, driven by a train of heavy-expansion gearing. The three pressure rolls are placed one over each drum. The feed is governed by a double belt-tightener, operated by a hand lever.

The Pittsburg Railway Company is to install twenty emergency straight air brake equipments for motor cars with CP-21 air compressors, and ten emergency straight air brake equipments for trail cars, furnished by the General Electric Company. The cars upon which these equipments will be mounted are to be run singly and in two-car trains, consisting of one motor car and one trailer. The type of air brake equipment above mentioned, sometimes called "semi-automatic," is essentially a straight air brake system, having in addition an emergency valve on each car, which, in case the train breaks apart, disconnects the brake cylinder from the train line, and connects it directly to the main reservoir, thus applying the brakes on all cars, just as in the automatic system. In ordinary service, the operation is exactly the same as with a standard straight air brake system.

CARS FOR THE GULFPORT-BILOXI LINE

Ten cars of the grooveless-post semi-convertible type, like the one illustrated, have just been finished by the J. G. Brill Company, and shipped to Gulfport for use on the 28 mile line between Biloxi, Gulfport and Pass Christian, which will be in operation about May 1. The State of Mississippi has a coast line on the Gulf of Mexico, seventy miles long with excellent harbors, and skirted by a division of the Louisville & Nashville Railroad. The line of the Gulfport & Mississippi Coast Traction Company parallels the steam line, and is expected to obtain practically all the passenger traffic between these points and towns along the route, on account of the fine cars, more frequent service and fast schedule. In the STREET RAILWAY JOURNAL of Aug. 5, 1905, was described a shipment of semi-convertible cars from the John Stephenson Company to the Biloxi Electric Railway & Power Company. The systems at Biloxi and at Gulfport are controlled by the same interests as the new interurban line, the former having a trackage of seven miles and the latter three miles. A new power plant and car shed are being constructed at Gulfport, and a 1500-kw plant with two direct-connected turbines is being installed.

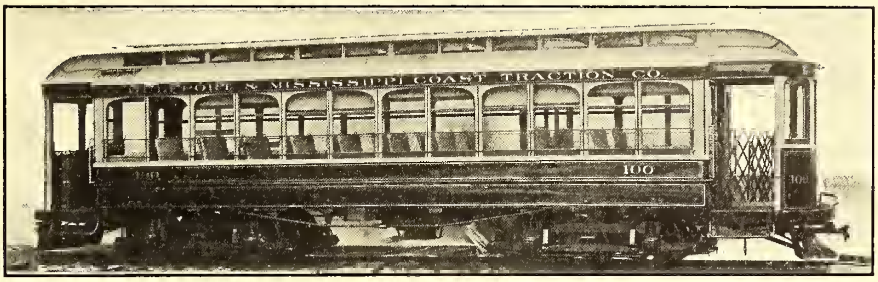
The illustration of the car exterior shows how admirably the car builder's semi-convertible window system is adapted to the twin-window arrangement. The arrangement gives a massive appearance to the exterior, which is in keeping with interurban service. The same curved lines will also be noticed in the ventilator sashes and the transoms. There are two compartments with a total seating capacity of forty-

INTERIOR OF GULFPORT-BILOXI CAR, SHOWING DIVISION INTO COMPARTMENTS

eight, twelve of which are in the smoking compartment. The seats, which are of Brill manufacture, have high step-over backs with head-rolls. Wide net window guards are used on account of the low window sill, the top of which is but 25 ins. from the floor.

The interiors are finished in cherry of natural color, with ceilings of decorated birch. The partition, window sashes, doors and moldings are also of cherry. The bronze trim is of generous dimensions, and includes large individual parcel racks. Besides the incandescent lights, which are placed along the center of the dome, lights are distributed at intervals along the lower ventilator rails. The car builder's folding gates close the platform entrances, and the platform gongs, signal bells, draw-bars, bumpers and other specialties are of the same make. Small pilots are attached to the platforms with angle irons and round iron bars, in such a manner as to keep them from projecting beyond the end of the draw-bars. The air brakes are fitted with connections, as it is intended to run the cars in trains.

The general dimensions are as follows: Length over the



ONE OF THE NEW CARS FOR THE GULFPORT & MISSISSIPPI COAST TRACTION COMPANY

end panels, 33 ft. 4 ins., and over the vestibules, 42 ft. 9 ins.; width over the sills, including the panels, 8 ft. 2½ ins., and over the posts at the belt, 8 ft. 6 ins.; sweep of the posts, 1¾ ins.; distance from the center to the center of the side posts, 2 ft. 8 ins. The side sills are 4 ins. x 7¾ ins., and the end sills, 5¼ ins. x 6⅞ ins. There are 12-ins. x ⅜-in. sill plates on the inside of the sills. The thickness of the corner posts is 3⅝ ins., and of the side posts, 3¼ ins.; the length of the seats, 38 ins., and the width of the aisles, 22 ins. The cars are mounted on No. 27-E-1½ trucks, which have 6-ft. wheel base, 33-in. wheels and 5 in. axles.

POWER FOR THE SIMPLON TUNNEL

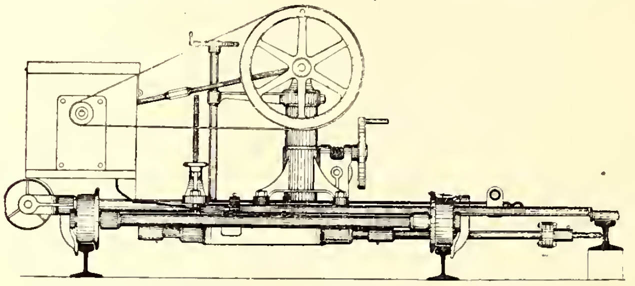
It is announced that the hydraulic power of the Videria and Rhone Rivers is to be used in operating a turbine station, which will furnish current for the coming electric trains in the Simplon tunnel between Switzerland and Italy. The operating current sent from the sub-stations will be 2300 volts, three-phase. The dam now under construction is about 500 ft. long, and is arranged for a 30-ft. head. In the two turbine halls there will be eight pairs of 3000 hp, each running at 200 r. p. m., with their shafts continued to the 25-cycle, three-phase, 500-kw generators in the center hall. For transmission to the sub-stations, the potential is raised to 33,000 volts by oil transformers.

ANOTHER SINGLE-PHASE RAILWAY IN SWITZERLAND

The Maschinenfabrik Oerlikon, of Oerlikon-Zurich, Switzerland, has received a contract for equipping with single-phase apparatus, the Valle Maggia Railway, connecting Locarno and Bignasco, Switzerland. This line is 27.5 km (22 miles) long, is of 1 m. (39.37 ins.) gage and built for trains weighing up to 55 tons. The operating current, 5000 volts, will probably be generated in a 700-kw hydro-electric station 16 km (12.8 miles) from one of the terminals. Each car will be equipped with four 40-hp single-phase motors, and will carry the Huber side-contact collectors, previously described in these columns. This line is the second single-phase line in Switzerland, and its electrification, according to this system, is the direct result of the Oerlikon Company's successful experimental work on the Seebach-Wettingen line as described in the STREET RAILWAY JOURNAL of Feb. 24.

AUXILIARY DEVICE FOR DRILLING CURRENT RAIL

The accompanying view illustrates the new attachment which has been placed upon the Ludlow track-drilling machine for third rail work. This attachment can

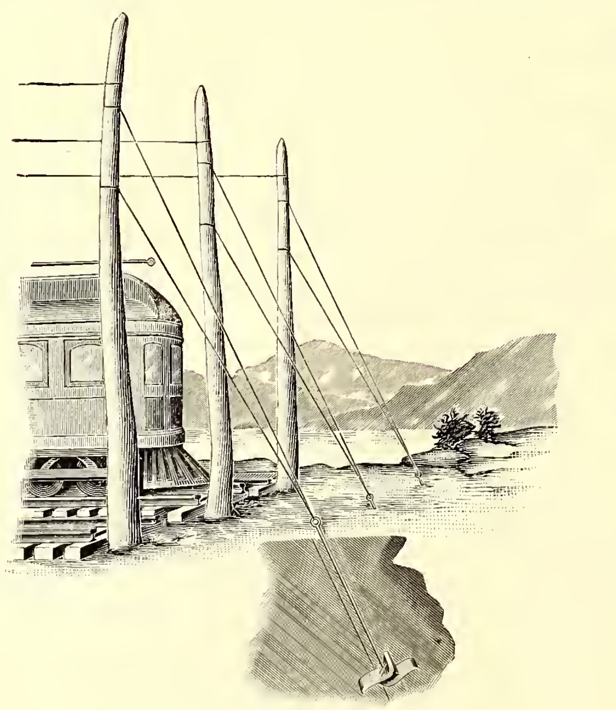


TRACK DRILL FOR THIRD-RAIL WORK

be applied to any of these track drills now in use. All of the parts that connect the machine to the third rail are insulated, and hence the drilling can be done without danger to the operator of the drill. This drill is now manufactured by the Cleveland Armature Works, of Cleveland, Ohio.

A SIMPLE TROLLEY ANCHOR

For over a year, the Western Ohio Railway Company, of Lima, Ohio, has been successfully using a pole-guying device, known as the Wapak anchor, and made by the Wapak Hollow Ware Company, of Wapakoneta, Ohio. The construction of this anchor is apparent from the accompanying



GUY WIRE FASTENED TO ANCHOR

cut, showing its appearance in service. The anchor can be set in less than half an hour by one man, wherever a 4-in. or 7-in. hole can be put down, and the only tool needed is a common post auger with a 5-ft. handle. When once set and adjusted this contrivance needs no further attention, and will easily outlast the pole, as it is made of iron covered with asphaltum to render it rust-proof. When preparing to guy a pole, a hole should be made not less than 4½ ft. deep, and just large enough to let the anchor go down when folded up. When set, the blades should point right and left—not up and down. The blades should be spread, the earth tamped in between them to hold them apart, and the hole tamped full. When the anchor and the post or pole are connected by wire, it should be stretched tight before any twisting is done.

The blades will, generally, spread of their own weight; and are so curved that they will catch in the bank when the earth is tamped in between them. Under the pressure of tightening, the blades will spread out, entering the bank, and standing at, or near, right angles. By reason of this spreading of the blades the Wapak anchor has two great advantages: First, its holding service is greatly increased, and, second, it is held by the unmoved sub-soil of the bank into which it has been thrust.

These anchors are sold in a number of sizes, suitable for different strains. For the convenience of users of this device, the company carries in stock the Iwan post augurs to be used in connection with the setting of this anchor.

SUB-PRESSES FOR DIE WORK

In almost every railway shop, it is convenient to have a machine for stamping out different metal shapes such as figures, letters, discs, etc. For this class of work George M. Griswold, of New Haven, Conn., constructs a device for die work known as a "sub-press," and which is stated to be decidedly better than the old style of blanking dies. The sub-press is made for the purpose of holding the punches and dies in perfect alignment, and to avoid injuring or shearing the punches while setting them in the power press. The sub-press dies are made on an entirely different principle than the old blanking dies, which usually require two or more operations to produce a finished blank. The sub-press die makes the complete blank with all of the holes, monograms, figures, or whatever is ordered stamped into it, by one stroke of the press. As the stock is clamped firmly while the blank is being cut, each and every piece turns out perfect and exactly like its original.

SUB-PRESS FOR DIE WORK

This device is always ready, and only requires to be placed in the power press. It does away entirely with the trouble of delicate punches, so often spoiled by the old way of setting them. Furthermore, the sub-press is a little machine complete in itself, with punches always set and in perfect alignment. It is claimed that, in the long run, sub-press dies are by far the cheapest, wherever accurate work is essential. An ordinary power press, with an opening of about 10½ ins. between the gate and the bed, will answer for sub-press dies, but the manufacturer advises the use of a power press made especially for sub-press purposes.

While Mr. Griswold makes a large variety of sub-press dies, he does not confine himself to this line, but also is prepared to furnish to order all kinds of special machines and tools which cannot be found in the open market. One of his latest designs is a toggle-joint power press for sub-press dies, to punch out armature discs and other parts that must be made to a high degree of accuracy.

A NEW RECORDING REGISTER

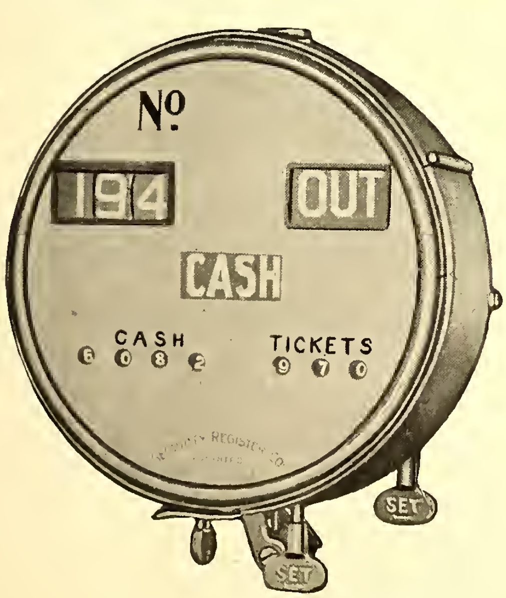
The Security Register Company has been engaged for a number of years on the development of a recording register, but has been unwilling to place any of these registers on the market until they should have been perfected. The company now announces that such a register is ready for the market, and that it has sold a number to different railway companies.

In outside appearance and size, the register resembles the well-known non-recording registers of the company, except that it is about half an inch thicker. It is made in both the single and double types. The record is made on a roll of paper, which in the double registers is 2½ ins. wide, and in the single registers is 1½ ins. wide. Every time a conductor takes or leaves a car and at every change of the direction plate, the reading of the totalizer is printed on this strip of paper. The register also allows an identification of the conductor who is operating the car, and of any inspector who may board the car to inspect the register, and also records the number of the register itself. This latter is to assist the auditing department in checking up the records.

	6	
544	7061	100
536	7051	
519	7031	
504	7013	
488	6995	100
471	6977	
456	6961	
	6	
	10	
456	6961	100
456	6961	
441	6942	
426	6925	100
412	6909	
	10	

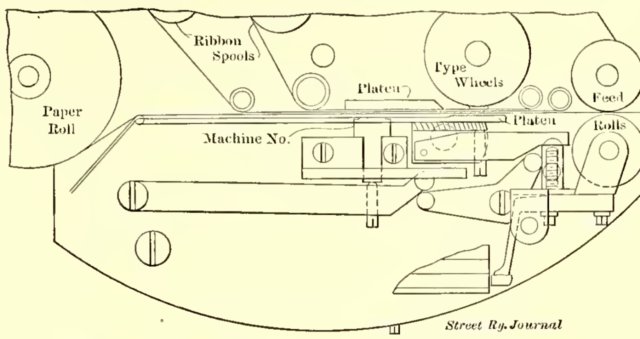
FORM OF RECORD FROM REGISTER

On many roads, it is the practice of the starter at the car house to ring each register a few times before the cars start out to see that the registers are in good condition. With the recording register illustrated, the starter first inserts his identification stamp in a hole in the base of the register. This stamp carries his number, and stamps this number on the record strip. The identification stamp is then withdrawn, and an operating handle is inserted. This records the reading of the totalizer and the register number. If a double register is used, it records both cash and ticket totalizer readings as they are at the time, and also the register number. Until the operating handle is inserted, the register is dead and no fares can be rung up upon it. After testing the register, the starter reinserts his identification stamp to show that all the fares recorded within his identification-stamp marks on the strip were for testing purposes only, and must not be charged to anyone. He then hands the operating handle to the conductor, who first marks the record with his identification stamp, then inserts the operating handle and is then ready for business. The insertion of both the operating handle and the identification stamp feeds the recording ribbon a short distance, so that the records are not superimposed on each other, and after the operating handle is inserted in the register it must be turned all the way through, and make a record before it can be withdrawn.



DOUBLE RECORDING REGISTER

After the car leaves the car house, the register is operated exactly like an ordinary register, the conductor keeping his day card as usual. Every time he turns his direction



WORKING DETAILS OF RECORDING REGISTER

plate, these readings are automatically printed on the record strip to which the conductor has no access. When a conductor leaves the car he withdraws the operating handle, and this makes a record of the totalizer. He then inserts his identification stamp, indicating that he has completed his run. He then turns his operating handle over to the next conductor, who proceeds like his predecessor.

A glance at the accompanying reproduction of a typical record from a double machine, will make the method clear. Here, the two small numbers 10 indicate that conductor No. 10 collected on four half trips 456-412 or 44 tickets, and 6961-6909 or 52 cash fares. The car was then taken by conductor No. 6, who in six half trips collected 544-456 or 88 tickets, and 7061-6961 or 100 cash fares. It also shows that the register number was 100.

If desired, inspectors can be required to mark the register record when they inspect a car on the road, and thus make a record of their visits.

The mechanism of the recording device can be seen from the section herewith. A paper strip is carried on the roll at the left hand, and is fed from the feed rolls at the right, and then is rolled up over a reel at the right. The paper tape passes over the recording typewriter ribbon, and has an automatic feed. At the end of the day the inspector at the car house opens the register, stamps the day, hour and car number, and sends the record to the auditing department, where the number of fares registered by each conductor can easily be obtained by subtracting his lowest from his highest number. Each reel will carry enough paper for over 3000 impressions, or sufficient to last anywhere from 30 days to 60 days, according to the number of trips made per day. The last few feet of the recording paper, or enough for three or four days, are of a different color from the rest, so that the inspector can tell when the paper needs replenishing. The recording ribbon will last from eighteen months to two years. The gears and other wearing parts in the register are of the best cut steel.

FINANCIAL INTELLIGENCE

WALL STREET, March 7, 1906.

The Money Market

There has been a material improvement in the monetary situation during the past week. The heavy liquidation in the stock market, which has been in progress practically throughout the entire period, has released considerable amounts of funds heretofore tied up in speculation. This, together with the announcement by the Secretary of the Treasury that he would deposit $10,000,000 Government funds with the depository banks at the principal centers, caused a more liberal offering of funds by local lenders, which was reflected in lower rates for all classes of accommodation. No announcement has been made as yet as to the exact manner in which the Government money above referred to will be deposited in the banks, but in well informed circles it is believed that the Secretary of the Treasury will distribute the entire amount among the depository banks in the near future. Bankers and other lenders, however, do not look for any decided reduction in rates until the spring demand for money at interior points, which is still urgent, has been satisfied, and money is again moving in this direction. Government finances continue to improve. Foreign exchange has ruled somewhat steadier, owing largely to a sharp falling off in offerings of finance bills and sterling loans. The European markets have ruled easier, money and discounts at London and Paris showing a decidedly easier tendency. The bank statement published on last Saturday made a far better exhibit than had been expected. Loans decreased $8,463,100, due largely to the shifting of loans from local to foreign bankers. Deposits decreased $12,753,700. Cash decreased $3,305,400, but as the reserve required was $3,118,425 less than in the preceding week, the decrease in the surplus was limited to only $116,975. The surplus now stands at $5,008,750, as against $5,125,725 in the previous week, $8,389,700 in the corresponding week of 1905, and $29,943,350 in 1904.

Money on call ranged between 7 and 4 per cent, the average for the week being about 5 per cent. Time money was obtainable at 5½ per cent for sixty days to four months, a decline of ¼ per cent, while five and six months maturities were quoted at 5¼ per cent, which is also ¼ per cent lower than the rate prevailing at the close of last week. Price mercantile paper was quoted at 5¼ per cent.

The Stock Market

The month of March in the stock market has been ushered in much after the style of the proverbial lion, but whether it will go out as the lamb is a matter that can only be conjectured. From present indications the balance of the month is likely to witness more or less unsettlement in the market, not that there is anything radically wrong in the situation, but simply because of the present speculative temper. As a matter of fact, there has been little or nothing thus far on which to base any such selling movement and consequent serious decline in values as has taken place during the past week or so; on the contrary, practically all developments of an important nature have been of a character which ordinarily would have inspired unbounded confidence in the future of values and have occasioned general buying of securities. The announcement of the Secretary of the Treasury that he would deposit $10,000,000 with the banks of this and other cities was certainly reassuring, but instead of having a good influence it seemed to inspire more or less apprehension that monetary conditions were not as they might be, otherwise Secretary Shaw would not have resorted to the measure noted.

The reports received from railways throughout the country showed a most remarkable state of prosperity, and the exceptionally open winter was reflected in especially gratifying increases in net earnings for the month of January and other periods. Increased strength was noted in the copper metal market, and while the iron and steel trade was reported dull by comparison, there was no evidence of any shading of prices. In a word, fundamental conditions were all that could be desired, yet values crumbled under the force of liquidation of long stock, combined with heavy bear pressure, which brought prices to a lower level than on any occasion since last autumn. Great stress was laid upon the possibility of a coal strike this spring, while the affairs of the larger insurance companies were pointed to as a highly disturbing element. The shares of the anthracite coal companies and those of the copper producing properties were made to stand the brunt of the selling pressure, but stocks of all classes suffered more or less, and while there were frequent rallies, these were invariably of a feeble order and at the close the market was in a feverish and uncertain state.

The stocks of the local traction companies sympathized to a greater or less extent with the downward surge in the general list, but all things considered they acted quite well under the circumstances. This, no doubt, is explainable by the present and prospective large earnings of all these properties, a striking illustration of which was afforded by the report of the Brooklyn Rapid Transit Company for the last fiscal year, showing an increase in gross earnings of $2,033,351 and in net of $1,216,344. The announcement that a syndicate has been formed to underwrite a portion of the new Interborough-Metropolitan securities seemed to have a reassuring effect, as there had been some confusion as to what would be done with the vast amount of securities which this company is to issue.

Philadelphia

Trading in the local traction stocks developed larger proportions during the past week, and although prices moved with more or less irregularity the net changes were small considering the weakness prevailing in the general securities market. Interest centered in the shares of the Philadelphia Company, all of which were extremely active. At the opening of the week there was a disposition to sell the common stock, but as all offerings were readily absorbed, the price was not lowered materially. From 52½ at the opening the price ran off to 51 on transactions aggregating about 18,000 shares. Upwards of 1200 shares of the preferred stock changed hands at from 50¼ to 50. The receipts issued for stock deposited in accordance with the United Railways purchase plan were active and strong, and at one time were selling about 3 points above the non-assessed stock. Opening at 52¼ the price rose to 54, and closed at 53½. Receipts for about 25,000 shares of stock were dealt in. Philadelphia Rapid Transit opened firm at 32, but subsequently there was a decline to 30½, on the transfer of upwards of 8000 shares of stock. Consolidated Traction of New Jersey was quiet but firm, several hundred shares selling at 82⅛ and 82½. Union Traction brought 63½ and 64¼ for about 500 shares. Other transactions included American Railway stock at 52½ and 51¾ ex dividend; American Railway warrants at ¼ and 1⅜, Fairmount Park Transportation at 20, Philadelphia Traction at 101¼ and 101⅛, Thirteenth and Fifteenth Passenger at 302, United Traction of Indiana at 31 and 32, and Rochester Railway & Light at 98.

Baltimore

The market for tractions at Baltimore has been fairly active and generally strong, about the only weak feature being United Railway 4s, which declined about 2 points to 92¼, on sales of about $45,000 bonds. United Railway stocks and income bonds, on the other hand, were comparatively strong, the free stock selling at 17⅝ and 17½ for about 1400 shares, while the deposited stock brought 18½. The free incomes advanced from 73 to 74, and closed at 73⅝, on dealings of about $175,000, while the certificates representing deposited incomes sold to the extent of about $310,000 at from 71½ to 72⅛. Norfolk Railway & Light 5s lost ¼, $3,000 selling at 100½ and 100¼. City & Suburban 5s advanced a fraction to 106 on the purchase of $7,000. Other sales included Charleston City Railway 5s at 105¾ and 106, Citizen's Railway & Light 5s, of Newport News, at 88½ and Knoxville Traction 5s at 108½.

Other Traction Securities

The Chicago market has been absolutely featureless, trading being confined almost exclusively to odd lots. South Side Elevated broke 1½ points to 93, on sales of 280 shares. Metropolitan Elevated common brought 28, and the preferred 68 and 68½. Other sales were: Chicago City at 198, North Chicago at 75, Chicago & Oak Park at 7¼, the preferred at 27¼, Northwest Elevated at 28¼ and the preferred at 68½ and 68. The Boston market was heavy. Boston Elevated lost a point to 154. Boston & Worcester common and preferred declined 1 and 2 points respectively, the former to 31 and the last named to 81, despite the favorable statements of gross earnings for the month of February, showing an increase of 27 per cent over those for the corresponding month last year. Massachusetts Electric common, after selling at 20 at the opening, dropped to 17½, but later rallied a fraction. The preferred declined from 68 to 67. Boston & Suburban sold at 23. West End common sold at 99¾ and 100, and the preferred brought 115. In the New York curb market the Interborough Rapid Transit stocks have been extremely active, and prices held remarkably well considering the extensive liquidation in the general stock market. Interborough Rapid Transit opened at 227½ and broke sharply to 219, but toward the close the price advanced to 229, at which it closed. About 15,000 shares were dealt in. Interborough-Metropolitan common declined from 53 to 51⅛, but later rallied to 52⅛, upwards of 24,000 shares changing hands. The new preferred stock sold to the extent of about 8000 shares, at from 91 to 88 and back to 89, while more than $1,000,000 of the new 4½ per cent bonds were traded in at from 92¼ to 90¼ and back to 90⅝. Other sales included American Light & Traction at 122 and 121½, the preferred at 101 and 101¾; New Orleans Railway common at 36¾ and 35¾, the preferred at 83½ and 82; North Jersey Street Railway 4s at 78 and interest, and Public Service Corporation 5 per cent notes at 95¼ and interest.

The event of the week in Cleveland was the fluctuations of the Cleveland Electric Railway securities, due to State legislation. For two weeks the stock had been going down hill, owing to the probability of the passage of the Metzger bill. Upon the announcement of the defeat of this measure the stock jumped from 75 to 83. Sales aggregated about 1800 shares. Aurora, Elgin & Chicago preferred sold up from 95½ to 95¾. Elgin, Aurora & Southern sold to the extent of 600 shares, with an advance from 51 to 51½. Northern Ohio Traction & Light sold at 31½. The 4 per cent bonds sold at 74½. Cleveland Electric sagged to 81, with a deal at sixty days delivery at 82½. A small lot of Lake Shore Electric common sold at 15½, a decline of a point. Muncie, Hartford & Ft. Wayne sold at 40¼ for several lots, a decline of 1½. Toledo & Western securities showed some activity at Toledo, several blocks of the bonds selling at 89½ to 90, and the stock at 15. Columbus Railway & Light, in the last two weeks, went to 85, down to 80, back to 85, and then down to 82½. Columbus Railway common is scarce at 103, and the preferred stands at 110, with few offerings. Cincinnati, Newport & Covington common sold at 51½, a fractional decline. The preferred also fell off ½ to 97¼. Cincinnati Street Railway was inactive at 146¼. There was a small sale of Detroit United at par.

Security Quotations

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

	Feb. 28	Mch. 7
American Railways	51¾	51½
Boston Elevated	154½	154
Brooklyn Rapid Transit	80¼	79⅝
Chicago City	193	—
Chicago Union Traction (common)	—	—
Chicago Union Traction (preferred)	11½	12
Cleveland Electric	44	—
Consolidated Traction of New Jersey	81½	81
Detroit United	99½	97¼
Interborough Rapid Transit	220	228
Interborough-Metropolitan Co. (common), W. I	53	51
Interborough-Metropolitan Co. (preferred), W. I	90	88
Interborough-Metropolitan Co. 4½s, W. I	92	90½
International Traction (common)	—	37¼
International Traction (preferred) 4s	—	73½
Manhattan Railway	155	156½
Massachusetts Elec Cos. (common)	18	18½
Massachusetts Electric Cos. (preferred)	66	67
Metropolitan Elevated, Chicago (common)	28	28
Metropolitan Elevated, Chicago (preferred)	68	68
Metropolitan Street	113½	115
Metropolitan Securities	66⅞	71¼
New Orleans Railways (common)	36½	35½
New Orleans Railways (preferred)	83	80½
New Orleans Railways, 4½s	90	89½
North American	98½	98¼
North Jersey Street Railway	27	27½
Philadelphia Company (common)	51¼	50⅞
Philadelphia Rapid Transit	31	30½
Philadelphia Traction	101	101
Public Service Corporation 5 per cent notes	94½	94½
Public Service Corporation certificates	72	72
South Side Elevated (Chicago)	94	93
Third Avenue	131	132½
Twin City, Minneapolis (common)	117	116½
Union Traction (Philadelphia)	63¼	63
West End (common)	99	99½
West End (preferred)	113½	114

W. I., when issued.

Iron and Steel

The "Iron Age" says that so far as new business is concerned, in nearly all lines of crude and finished iron and steel, the week has been a very dull one. As an indication of the situation, the statement may be made that the United States Steel Corporation is booking new business at the rate at which deliveries are being made. No business for very distant delivery is being taken, and orders are closely scrutinized to prevent speculative purchases. The volume of business may therefore be designated as normal, in contrast with the extraordinary volume during the winter months. Reports from all the distributing centers show the pig iron trade to be very dull.

OHIO BILL DEFEATED

The Metzger bill, introduced in the Ohio Legislature at the request of Mayor Tom L. Johnson, of Cleveland, was defeated in the House last week by a vote of 56 to 49. The bill was most obnoxious to the street railway interests of the State, and was directed especially at the Cleveland Electric Railway in Mayor Johnson's fight for 3-cent fare or municipal ownership in that city. It provided that street railway franchises should be submitted to a vote of the people instead of depending upon the securing of the majority of foot frontage on a certain street, as at present. It provided that the question of municipal ownership should be submitted to the people to be decided by vote, and it also provided that a property owner on a street could not block the building of a street car line, except a majority of the people on the street enter written protests. This last clause was injected into the measure at the eleventh hour in the hope of saving it.

AFFAIRS IN CHICAGO

Judge Grosscup has granted permission to Henry S. Robbins, attorney for the North and the West Chicago Street Railroad Companies, to file a petition asking a forfeiture of their leases to the Union Traction Company on the ground that it had failed to pay the rentals since September, 1903. Attorney Robbins maintained that the revenues of the Union Traction Company should be applied to the payment of the rentals. He has been given until April 10 to complete taking testimony in the suit for a forfeiture of the leases, because the Union Traction Company, as he alleges in his petition, has not paid the $3,416,000 of floating indebtedness of the underlying companies, whose payment was assumed at the time the United Traction Company obtained the original leases. The defense is given ten days after April 10 in which to introduce its testimony. The court protested against further delay in the taking of testimony and directed Master in Chancery Bishop to send him the testimony without a report on either the law or the facts. Judge Grosscup indicated his intention to push the settlement of the Union Traction receivership. At the time of the reference of the case to the master he said the court wanted it quickly disposed of and the joint accounts of the companies settled.

In an ordinance submitted to the local transportation committee the Metropolitan Elevated Railroad Company indicates an intention to reach out for suburban business and offer terminal facilities for interurban electric lines. General Counsel Gurley offered an ordinance as a substitute for the one presented to the Council a few days ago, in which he asked for an extension of the Douglas Park branch as well as of the Humboldt Park line. The Douglas Park branch will connect with the Suburban Electric line at Forty-Sixth Avenue, and it is the intention to extend the Humboldt branch to the Desplaines River. The electric line operating in the Fox Lake region is expected to use this branch as a Chicago terminal. It will pass through or near Hermosa, Cragin, Mont Clare, the Westward-Ho golf links, and other villages or frequented places.

PRETENTIOUS COMPOSITE SUBURBAN SYSTEM FOR CHICAGO

Announcement was made in Chicago last week that there is soon to be incorporated in New Jersey a $50,000,000 corporation which will carry out the long contemplated plan of constructing an elevated and an electric railway to tap the most populous districts in Northern Illinois and Indiana, connecting them with Chicago. The project contemplates the building of an elevated structure above the present Lake Shore & Rock Island tracks, its business terminus being at the depot at Van Buren Street. The tracks are to be elevated as far as Washington Heights, where they will descend to the ground, in the same manner as the Oak Park Elevated Railroad, and run for the remainder of the distance as a suburban trolley.

The proposed corporation is promoted by the Moore brothers, of the Rock Island; Robert Mather, of the Rock Island holding company; President Yoakum, of the Frisco system, and by William S. Reed, who is the president of the three traction companies which will enter into the coalition.

It is proposed to build roads outright through the territory which is to be traversed, but some of the lines which have already been built will be taken over. As a preliminary to the coming arrangement Mr. Reed purchased a number of these lines last fall. Both the Lake Shore and Rock Island roads will have stock in the new company, and Mr. Reed will turn in the following properties:

Chicago Electric Traction Company, running from Sixty-Third Street and South Park Avenue to Harvey, a distance of 32 miles.

Chicago Southern Traction Company, running from Harvey to Kankakee, with a branch from Blue Island to Hammond, and having a total length of 38 miles.

Chicago, Blue Island & Joliet Traction Company, running from Blue Island to Joliet, a distance of 25 miles.

This will give a total straightaway trackage of 95 miles without the necessity of building any new lines, but it is proposed to make traffic arrangements with the Chicago, Kankakee, Lafayette & Southeastern, which connects Kankakee with Lafayette, and from that point with many of the Indiana suburban lines; with the Chicago & Indiana air line roads, running from Hammond to South Bend, and with the McKinley syndicate, whose lines parallel the Chicago & Alton to St. Louis and terminate at Joliet.

The elevated portion of the structure will be equipped with depots, beginning at Twenty-Second Street, at every five blocks south of that, as far as Sixty-Third Street, below which the present Lake Shore and Rock Island stations will be utilized.

The Lake Shore and Rock Island Railroads will surrender their entire suburban business, which will be carried by the new company. The new service will also make a most important point of Blue Island, where most of the roads will center and from which cars will run over the surface lines to the elevated structure at Washington Heights.

The elevated structure will hold four tracks, two for through service and two for local traffic. The tracks to be elevated will be 10 miles in extent. In addition to affording terminal facilities for the present immense interurban electric service, it is supposed that the lines hereafter reaching Chicago will avail themselves of the same terminal facilities.

The financial portion of the project contemplates an issue of $35,000,000 capital stock in common shares, $5,000,000 non-cumulative preferred shares, and $10,000,000 in thirty-year gold bonds bearing 5 per cent interest. On this capitalization it is figured that the annual receipts will be a little short of $4,000,000, with operating expenses of $2,493,275, including $500,000 interest on bonds. The properties included in the deal, as to cash values, are listed as a track mileage of 193 miles, 40 miles of which is elevated steel structure, $20,000,000; Chicago & Southern Traction Company, including the Chicago Electric Traction Company, $4,000,000; Blue Island & Joliet Railway Company, $1,000,000; Blue Island & Hammond Railway, $1,000,000—or a total cost of $26,000,000. The estimated cost of construction is $6,235,466.

Attorney Charles F. Davies, general counsel for the company, says that the object of the company is ultimately to operate an electric railway between Chicago and Indianapolis, and in view of this plan is gradually extending its lines toward Chicago and the Indiana city. A line is now being operated between Sixty-Third Street and South Park Avenue and Harvey over the old storage battery line.

At the offices of William S. Reed it was admitted that plans similar to those reported were under consideration, but it was stated they were not far enough advanced to give out definite information.

HEARING ON FREIGHT BILL IN NEW JERSEY

The hearing held at Trenton on Monday by the Senate committee on railroads and canals on the Waklee repealer of the law of 1896, which prohibits the transportation of freight and express in New Jersey by electric railway, seems to indicate the likelihood of the passage of the measure. The bill is a compromise, and has been accepted as partial relief by the farming interests, who have for several years been vainly petitioning for the repeal of the entire act of 1896, to the end that the companies might have unrestricted freight rights. The only opposition to the bill is that of the steam railroads, which contend that the electric railway companies, to carry freight, should organize under the general railway laws and not use the public highways. Judge Gilbert Collins, who opposed the report of the bill as the representative of the Erie and the Lehigh Valley Railroads, said that no step should be taken that would jeopardize so enormous an amount of capital as is invested in steam railroads and effect so large a number of employees. Prof. Voorhees, president of the State Board of Agriculture, and D. T. Dens, ex-president of that body, both advanced convincing arguments for the electric railway interests. Prof. Voorhees said that within 50 miles of any New Jersey farm are markets that represent 7,000,000 of the richest people in the world, and that every means should be taken to provide for the expeditious marketing of farm products. This is impossible at the present time. Neither the Pennsylvania Railroad nor the Reading Company has so far opposed the measure.

ANNUAL MEETING OF THE NEW ENGLAND STREET RAILWAY CLUB

The New England Street Railway Club will hold its annual banquet on Thursday evening, March 22, 1906, at the Hotel Somerset, Boston. Among the speakers will be Hon. W. Caryl Ely, of Buffalo, president of the American Street & Interurban Railway Association, and Hon. George Tate Blackstock, of Toronto, Canada. The tickets, which cost $2.50 each, can be purchased of the secretary. Members may purchase tickets for guests until the committee considers that it is being done to such an extent as to exclude members. In addition to the banquet the annual business meeting of the club will be held at 3 p. m. of the same day, at the Hotel Somerset. Balloting for officers will begin at 3:30 p. m. and the polls will close at 5:30 p. m.

THE LOS ANGELES-PACIFIC DEAL

The report is again in circulation (and not controverted) that the Los Angeles-Pacific Railroad Company has disposed of its properties for $6,000,000. The purchaser is said to be E. H. Harriman, of the Southern Pacific, together with Kuhn, Loeb & Company and the Standard Oil Company. That Henry E. Huntington does not figure in the transfer, in spite of the generally accepted theory that he has long held an option on the property, is conceded. At the Huntington railway headquarters here it is said that such a transfer of the Los Angeles & Pacific would be undoubtedly regarded by Mr. Huntington as a hostile move. For many years Mr. Huntington has been on the most friendly terms with both E. P. Clark, president, and Gen. M. H. Sherman, vice-president, of the railway company, it being known that the two interests have had a working arrangement, by the terms of which neither could enter the field of the other.

It is said that the purchase price of $6,000,000 will be equally divided between Mr. Clark and Gen. Sherman.

With the absorption of the Clark-Sherman interests by Mr. Harriman and his associates, it is highly probable that the Southern Pacific's Santa Monica steam line will be electrified at an early date. If Huntington has been shut out in the transfer of the Clark-Sherman lines, it is taken to mean that another break is due between the powers in control of what are known as the Huntington-Harriman lines.

Mr. Clark, when sought for an authoritative statement, would neither deny nor affirm the reported sale to the Harriman syndicate. It was admitted, however, that several extensive negotiations have been begun at different times for the company's entire property or the control of it.

E. P. Sherman, son of Gen. M. H. Sherman, has been appointed as general superintendent of the Los Angeles-Pacific Railroad Company, while Mr. C. H. Ellison, lately of the Southern Pacific, has received the appointment of chief engineer.

ANNUAL MEETING OF THE LOUISVILLE RAILWAY—IMPROVEMENTS PROPOSED

Extensions and improvements aggregating more than $800,000, to which reference has been made before in the Street Railway Journal, were decided upon at the annual meeting of the Louisville Railway Company, held a few days ago. At the meeting the following directors were elected, the only change being in the selection of Judge Alexander Humphrey, to take the place of the late St. John Boyle as vice-president and general counsel; T. J. Minary, Harry Bishop, J. B. Speed, Attilla Cox, Alexander P. Humphrey, Alexander Henry Davis, H. H. Littell, J. W. Gaulbert, Samuel Casseday, John Stites, Charles T. Ballard. The directors elected the following officers: T. J. Minary, president and general manager; Alexander P. Humphrey, vice-president and general counsel; J. B. Speed, chairman executive committee; Samuel G. Boyle, secretary and treasurer.

The report for the fiscal year showed earnings as follows:

Gross earnings		$2,298,619.13
Net earnings of Beargrass lines		15,288.41
Income from other sources		41,972.79
Total receipts for the year		$2,355,820.33
Operating expenses	$1,218,212.61	
Taxes for year	204,750.00	
Interest on debt	351,504.00	
Dividend on preferred stock	125,000.00	$1,899,456.61
Net earnings		$456,363.72
From which deduct dividend on common stock, paid and accrued		376,706.66
Surplus earnings		79,657.06
Set aside on account of depreciation of cars	$25,000.00	
Set aside on account of depreciation of machinery	40,000.00	
Balance carried to profit and loss		$14,657.06

In his report to the stockholders President Minary said:

"On May 17 there was sold to the highest bidder 200 of the 4½ per cent bonds of the company, at $1,030.50 and interest, amounting in all to $207,950, which was expended in improving the property.

"The Eighteenth Street line was extended from Pleasure Ridge to Valley Station, and extension operated on March 16. The line over the Preston Street road to Okalona was completed and put in operation June 1. The Louisville & Southern Indiana Traction Company commenced the operation of its cars from New Albany and Jeffersonville to Third and Market Streets in our city Sept. 13, over the Madison Street route, as per the agreement between the two companies.

"The Market Street line to Fontaine Ferry and Western Park, was double-tracked in April, ready for travel at the opening of the parks for the season. During the past summer an asphalt street was completed by the city over the unfinished portion of the old Shelbyville pike in Crescent Hill, and as the work progressed the single track of T-rails was replaced with a double track of 9-inch section, 100-pound grooved rails. The extension of the Second Street line from the House of Refuge over and along Shipp Avenue, G Street and Floyd Street, to the new shops of the Louisville & Nashville Railroad Company, and to the Central Stock Yards, was completed and put in operation Nov. 1. The Shelby Street line has been extended to Burnett Avenue, over and along Burnett Avenue to Texas Avenue, and on Texas Avenue to Goss Avenue, and the cars started upon the same during the present month.

"The new station on Jefferson and Green Streets, between Third and Fourth Streets, is nearing completion, and will be ready to accommodate the passenger business and for general offices of the company within thirty days, the freight or express cars having been operated from the station since Dec. 20.

"The interurban shops at East and Green Streets, which were built to accommodate the 4-ft. 8½-in. standard gage cars, were completed and occupied in August. The system has been improved during the year by additional large cables for the better distribution of power.

"During the coming year the management expects to make numerous improvements, such as adding new cars to the equipment, storage battery plant, new boiler house and boilers to the power plant, extension of the lines, and many other improvements of a small nature, at an estimated cost of $800,000. To provide for this it will be necessary to increase the capital stock of the company."

CAR CONSOLIDATION ABANDONED

The project of merging the principal street car manufacturing companies in a $56,000,000 combination has been abandoned, according to an official statement made by Kean, Van Cortland & Company, of New York, one of the banking firms which was to have financed the consolidation. The chief difficulty is understood to have been the price asked by at least one of the companies in the proposed consolidation for its property. G. Martin Brill, of the J. G. Brill Company, was to have been the president of the consolidated organization.

BROOKLYN RAPID TRANSIT EARNINGS FOR YEAR

The comparative income statement of Brooklyn Rapid Transit system for the year ended Dec. 31, 1905, compares as follows:

	1905	1904
Gross receipts	$17,493,011	$15,459,660
Operating expenses	10,078,923	9,261,916
Net earnings	$7,414,088	$6,197,744
Other sources of income	225,501	237,141
Total income	$7,639,589	$6,434,885
Charges and taxes	5,388,138	4,961,614
Surplus for year	$2,251,451	$1,473,271
Previous surplus	2,127,236	2,657,726
Total surplus Dec. 31	$4,378,687	$4,130,997
Of this amount there was appropriated—		
For discount of bonds sold	1,746,800	1,153,200
In adjustment of various accounts	12,600	5,652
For additions and betterments	288,145	844,909
Balance, surplus	2,331,143	2,127,236

The following is a consolidated general balance sheet as of Dec. 31, 1905, of Brooklyn Rapid Transit Company and constituent companies, with comparison:

Assets—	Dec. 31, '05	Jan. 31, '05
Cost of road and equipment	$105,484,656	$101,785,741
Adv. account construction leased companies	7,431,135	6,628,455
Construction expenditures constituent companies	4,053,167	1,374,567
Accounts to be adjusted	....	21,206
Guaranty fund (securities and cash)	4,005,755	4,005,755
Treasury bonds	1,617,500	2,649,000
Treasury stock	146,228	146,228
Cash on hand	1,342,105	2,903,123
Due from companies and individuals	514,748	346,585
Construction material and general supplies on hand	900,410	767,684
Real estate mortgages	6,500	....
Prepaid accounts	181,058	178,802
Discount on bonds	404,118	1,396,800
Total	$126,087,382	$122,203,948
Liabilities—		
Capital stock	$45,950,709	$45,959,605
Bonded debt	74,888,040	70,655,180
Real estate mortgages	329,640	....
Audited vouchers	1,155,606	561,870
Due companies and individuals	160,126	81,979
Taxes accrued	484,789	1,333,700
Interest and rentals accrued	640,183	525,402
Insurance reserve fund	51,428	21,428
Special reservation	10,000	....
Contractors' deposits	42,120	....
Long Island Traction Trust Fund	9,611	9,439
Accounts to be adjusted	33,985	....
Surplus	2,331,143	2,099,426
Loans and bills payable	....	900,000
Sundry accounts	....	25,867
Total	$126,087,382	$122,203,948

CAR HOUSE DESTROYED IN NEW YORK

The car house of the New York City Railway Company fronting on the North River, between Forty-Second and Forty-Third Streets, was destroyed by fire Sunday night March 4. Forty-two cars and seven sweepers of the Thirty-Fourth Street cross-town line were burned. The damage from the fire was estimated at about $150,000. The fire was discovered about 7:30 o'clock by one of the car cleaners, and is said to have started in a Forty-Second Street car, which stood on the most westerly track, about 100 ft. back in the barn. Four alarms were sounded.

SINGLE-PHASE FOR CONVERTED INDIAN ROAD

In connection with the Jhelum River hydro-electric power installation in British India, it is announced that a contract has just been awarded to the General Electric Company for the equipment to be installed in the plant and for converting the Cashmir section of the Jhelum Valley Railway, some 180 miles long, into a single-phase line. Included in the apparatus contracted for are twelve 1000-kw generators, to be direct connected to Doble turbines delivering 1765 bhp to the shaft under a head of 400 ft. Other electric apparatus under contract will include twelve 60,000-volt transformers, each of 1000-kw capacity, wire for the transmission lines, etc. The plant is to be located near Ramfur, about 50 miles below Sprinager, where there will be a 6-mile conduit. This is the second large undertaking of the kind entered upon by the government, the first being the Cauvery Falls installation, now in successful operation. The entire hydro-electric installation will be constructed, erected and placed in operation under the supervision of Major A. J. de Lotbiniere, R. E. A. C. Jewett, formerly of the General Electric Company, who was connected with the Cauvery Falls scheme, will serve as installing engineer for the government.

MAHONING VALLEY MERGER EFFECTED

The long talked of merger of the properties of the Pennsylvania & Mahoning Valley Railway, the Youngstown & Sharon Railway and the Sharon & New Castle Railway, and several subsidiary companies, has been effected, under the name of the Mahoning & Shenango Railway & Light Company. The company has control of 175 miles of city and interurban properties in and between Warren, Niles, Struthers, Youngstown and Lowellville, Ohio, and Sharon, Sharpesville and New Castle, Pa. It also controls the electric lighting systems in Youngstown, New Castle, Hubbard, Sharon and Sharpesville. The capital stock of the new company is $10,000,000. New officers have been elected as follows: E. N. Sanderson, president; Randall Montgomery, first vice-president; M. S. McCaskey, second vice-president; Alexander Webb, Jr., treasurer, and Leighton Calkins, secretary. Directors are as follows: E. N. Sanderson, of New York; M. A. Verner, of Pittsburg; James Parmelee, of Cleveland; A. T. Bannard, of New York; J. B. Dennis, of New York; Leighton Calkins, of New York; George W. Johnson, of New Castle, Pa.; Simon Perkins, of Sharon, Pa.

NEW YORK MERGER DECLARED OPERATIVE

The Merger of the Interborough Rapid Transit Company, Metropolitan Street Railway Company and Metropolitan Securities Company took place March 1, when Secretary Francis, of the Morton Trust Company, announced that sufficient shares of stock of the three companies had been deposited under the merger plan. Chairman Edward J. Berwind called a meeting of the organization committee, consisting of Andrew Freedman, John D. Crimmins, Thomas P. Fowler, Gardiner M. Lane and Cornelius Vanderbilt. After the merger agreement was declared in operation it was decided that all of the stockholders should be given a chance to deposit under the plan, and that stock of the Interborough and Metropolitan would be received up to Friday, March 16.

A meeting of the temporary organization of the new Interborough-Metropolitan Company was called by Vice-President Walter G. Oakman, of the Interborough Rapid Transit Company. The temporary organization is in the hands of Gen. James Jourdan, John B. McDonald, Morton F. Plant and Peter A. B. Widener. On the return of August Belmont, who is now at Palm Beach, the temporary organization of the new company will be superseded by the permanent organization.

The listing committee of the New York Stock Exchange held a meeting late in the afternoon of the same day, and authorized the listing of the certificates of deposit of the Metropolitan Street Railway Company and the Metropolitan Securities Company in the unlisted department, so that these certificates of deposit can be dealt in and used as collateral for loans in the same manner as the deposited stock. The temporary board of directors of the Interborough-Metropolitan Company adopted the necessary resolutions to make the plan operative.

The new Interborough-Metropolitan Company intends to adopt a broad policy, judging by the statements of President Vreeland, of the Metropolitan system, and Vice-President Bryan, of the Interborough Rapid Transit Company. Many plans were informally discussed by the operating officials of the two systems, and the prediction was made by several of the financiers that in less than six months the public would be greatly pleased at the improved facilities which would be extended by the new company. President Vreeland said:

"While there have been no definite plans made for changes or improvements in the transit facilities, pending the merger, from twelve years' experience with city transit, having to consider the general movement of traffic irrespective of whether it was carried on the surface, elevated or subway, I am convinced that many changes can be made in the operation of the systems that will be of great advantage to the public."

The common stock of the new company, amounting to $100,000,000, will be deposited under a voting trust agreement. The voting trustees will be August Belmont, Walter G. Oakman, Thomas F. Ryan, Cornelius Vanderbilt and Peter A. B. Widener.

The Interborough-Metropolitan Company on March 2 filed with the Secretary of State a certificate of increase of capital from $15,000 to $155,000,000. When the company was incorporated the capitalization was fixed at $5,000 preferred and $10,000 common stock. The certificate just filed increases the amount of the preferred stock to $55,000,000 and the amount of the common to $100,000,000. The certificate was signed by Walter G. Oakman, who was chairman, and Edward Cornell, who was secretary of the meeting of stockholders which was held on March 1 in New York.

RECENT IMPORTANT ORDERS FOR AIR BRAKES

The Westinghouse Traction Brake Company announces that since the first of the year it has received many large orders for air brake equipments for electrically operated railways. Among these are contracts for seventeen equipments for electric locomotives now being built by the General Electric Company and the American Locomotive Works for express service on the New York Central & Hudson River Railroad, electrical division. This style of equipment will be known as type ET, and is said to include a number of new features that have not yet been secured, either with the automatic air brake alone, or with the combined automatic and straight air brake equipment. Among these special features may be mentioned the following:

First. The locomotive brakes can be used in conjunction with the train brakes or not, as desired.

Second. The locomotive brakes can be released at any time without releasing the train brakes.

Third. With this equipment any given pressure in the brake cylinder on locomotive is automatically maintained indefinitely, irrespective of leakage or length of piston stroke, the only limitation being the capacity of the motor compressor employed to produce the air.

Fourth. Should locomotive wheels become locked, the brakes of the locomotive can be immediately released without releasing train brakes and can be reapplied with any degree of brake pressure.

Fifth. This new equipment materially reduces the number of parts used with the standard locomotive equipment, dispensing with triple valve, auxiliary reservoir, etc.

The Westinghouse Company is also building 125 AMR air brake equipments with D-2-EG compressors, for new steel cars to be operated on the suburban branches of the New York Central & Hudson River Railroad, electrical division.

Among other important recent orders for Westinghouse brakes are the following:

Fifty-eight equipments embodying the graduated release and quick recharge of auxiliary reservoir features, for the West Jersey & Seashore Railway Company. This is the division of the West Jersey & Seashore which is at the present time being electrified.

Forty AMR equipments, embodying electropneumatic features, with D-2-EG compressors, for the Philadelphia Rapid Transit Company. This AMR equipment with the electropneumatic feature is the latest type of automatic equipment designed for electric train service. With this equipment the following important results can be secured: Graduated release on all cars; quick recharge of auxiliary reservoirs; quick serial service application; no overcharging of brake pipe; prompt response of triple valves after full release, and independent operation of all compressors on a train.

Seven AMR equipments, embodying electropneumatic features, with D-2 compressors, for the Philadedphia & Westchester Traction Company, and the Philadelphia & Garrettford Street Railway Company.

One hundred SM-3 equipments with D-1 compressors, for the United Railways & Electric Company, of Baltimore. These equipments are in addition to the 160 similar equipments ordered in July, 1905, by the same company.

Twenty-six SM-1 equipments, for the Pacific Electric Railway Company, Los Angeles, Cal.

Fifteen SM-1 equipments for the Indianapolis Traction & Terminal Company.

Ten SM-3 equipments, with D-1 compressors, for the Lake Shore Electric Railway Company, Fremont, Ohio.

Six SM-3 equipments, with D-1-EG compressors, for the Lynchburg Traction & Light Company.

Fourteen SM-1 equipments, with D-2-EG compressors, for the Lima & Toledo Traction Company.

Thirty-five SM-1 equipments, with D-1 compressors, for the Indianapolis Traction & Terminal Company.

Ten SM-1 equipments, with D-1 compressors, for the Indiana Union Traction Company.

Thirty SM-3 equipments for the Metropolitan Street Railway Company, Kansas City, Mo.

Eight SME equipments, with XD-2-EG motor compressors, for the Pittsburg & Butler Street Railway Company, a single-phase road to go into operation this coming spring.

Twelve SM-3 equipments for the Syracuse Rapid Transit Company.

Five SM-1 equipments, with D-1 compressors, for the Nahant-Lynn Railway Company.

Eight AMT equipments, with D-1-EG compressors, for the Norwich & Westerley Railway Company.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED FEB. 27, 1906

813,416. Railway; Lewis Ginger, Colorado Springs, Col. App. filed Nov. 17, 1905. For ascending steep grades an elevator is provided for the reception of an ordinary motor car whose wheel engages friction wheels on the elevator, to there run the elevator by the car propelling means.

813,476. Brake Hanger; Owen Wittmer, Columbus, Ohio. App. filed Nov. 11, 1905. A bolster-guide column, the inner and outer faces of which are provided with vertical grooves, and a brake hanger provided with a pair of spaced flanges arranged to enter the grooves.

813,427. Railroad Motor Car; Clarence H. Howard, St. Louis, Mo. App. filed Dec. 1, 1905. Relates to the frame and floor of that class of railroad motor car, which is propelled by gasoline or other suitable motor, mounted theron and combined with weed-burning apparatus.

813,475. Car Fender; Albert B. Wilson, New York, N. Y. App. filed Aug. 29, 1905. Relates to means for the control of the fender by the motorman.

813,498. Car Fender; Martha E. John, Porsmouth, Va. App. filed June 15, 1905. A chamber normally closed by spring-controlled doors, arranged at an incline to the base of the fender, and a cushioning device movably mounted in the chamber.

813,506. Switch; George E. Lynch, Columbus, Ohio. App. filed Aug. 30, 1905. A switch for rack-rail systems providing continuity of the rack at the switch, and consisting of a pivoted section of rack adapted to bridge over the rail of the main line or siding, depending upon the position of the switch.

813,511. Brake-Operating Mechanism for Cars; John O. Neikirk, Chicago, Ill. App. filed Aug. 5, 1905. The operating wheel for the brake is mounted on a hinged head, adapted to swing into and out of operative relation with the brake staff.

813,515. Trolley Supporting Device; Alex. Palmros, Columbus, Ohio. App. filed April 11, 1900. Adapted for mine locomotives in which the trolley is horizontally spring-pressed against the conductor.

813,619. Acoustic Signaling Apparatus for Railways; Enrico Coen-Cagli, Naples, Italy. App. filed Oct. 24, 1902. In order to warn the driver that he is approaching a signal, there is provided a detonating apparatus, acted upon by the passage of a train, an anvil, an explosion chamber above the anvil for the expansion of the gases, and an oscillating plate, closing at each explosion an electric circuit in order to signal the explosion at the station.

813,632. Car Fender; Frank J. Fairchild, Detroit, Mich. App. filed June 21, 1905. Means for adjusting the fender a suitable distance above the track rails.

813,638. Electrically-Operated Controlling Mechanism; George H. Fretts, Springfield, Mass. App. filed May 13, 1905. For street railway switches, a solenoid and its core combined with a latch carried by the core and arranged to be attracted by the core on the energization of the solenoid.

813,691. Brake and Track-Sanding Mechanism; Murry A. De France, Newark, Ohio. App. filed Sept. 7, 1905. The application of emergency brakes simultaneously operates the track-sanding mechanism in a noved manner.

813,776. Fender; Andrew Chovan and Michael Gex, Allegheny, Pa. App. filed Aug. 21, 1905. The fender has its upper and lower ends mounted in longitudinally-slotted supports, and means provided for reciprocating the fender.

813,840. Insulated Rail Joint; McLeod W. Thomson, Altoona, Pa. App. filed April 10, 1902. The fish-plates have depending wings, which converge toward one another beneath the base of the rail and serve to hold an insulating wooden block which serves to strengthen the construction.

813,882. Electric Switch and Signal Apparatus; Lawrence Griffith, Yonkers, N. Y. App. filed Nov. 5, 1904. An interlocking signal system so arranged that the various indicators cannot respond to a signal as long as electric energy is supplied to the signal "motion-plates."

813,898. Automatic Block-Signal system for Electric Railways; Gray W. Johnston and Alex. H. Ackerman, New York, N. Y. App. filed April 25, 1905. Provides an overlap system by spaced contact plates along the road, which successively receive energy from the power circuit. Avoids the use of local batteries or track potentials, or other factors of variable or uncertain value.

813,938. Car Fender; Charles Bauer, New York, N. Y. App. filed Oct. 12, 1905. Details of construction.

813,996. Means for Electrically Connecting Railway Rails and the Like; John M. Atkinson, Chicago, Ill. App. filed March 15, 1904. The fish-plate has a V-shaped recess for the reception of the base of the rail, and a soft copper strip is embedded in the walls of said recess to contact with the rail.

813,998. Insulated Rail Joint; Bandroft G. Braine, New York, N. Y. App. filed Oct. 31, 1903. A bolt provided with a head at one end, and a screw-thread at the opposite end, an intermediate sleeve of insulation hugging the bolt and washers at the ends of the sleeve having recesses at the sides toward the sleeve.

NEW PUBLICATIONS

Advance Edition of "The Elements of Electrical Engineering, Vol. I. Direct-Current Machines, Electric Distribution and Lighting." By Prof. W. S. Franklin and Prof. William Esty, of Lehigh University. New York: The Macmillan Company; 368 pages; Illustrated. Complete edition to be ready in July; about 550 pages. Price $4.50.

This book is one of a series which is being prepared by the professors of physics and electrical engineering of Lehigh University primarily for class work in that institution, and for this purpose a limited number of advance copies were issued. The complete volume, which will be placed on the market by the publishers at an early date, will cover the entire subject given in the sub-caption, and will include chapters on storage batteries, electrical distribution and wiring, etc., which are not contained in the advance edition. The authors describe the theory, construction and operation of direct-current generators and motors in a lucid and complete manner, and their work can be recommended as an excellent treatise for class work or for any one who wishes to acquire a knowledge of the principles of these machines.

PERSONAL MENTION

MR. CHARLES H. TURNER, ex-president of the St. Louis & Suburban Railroad, died a few days ago at the Waldorf-Astoria. He was a member of the financial firm of Rowland, Knapp & Company, of New York.

MR. NORMAN McD. CRAWFORD, formerly general manager of the Hartford Street Railway Company, who has been appointed by the municipal ownership committee of the National Civic Federation to investigate municipal ownership of street railways abroad, is to sail March 10, on the "Coronia."

MR. HORACE E. ANDREWS, president of the Cleveland Electric Railway Company, will sail March 10 for a two months' automobile trip through Europe. Mr. Andrews will pay some attention to the street and interurban railway situation in Europe and will inspect the subway in London built by the late Mr. Chas. T. Yerkes.

MR. MARTIN STEIN, assistant auditor of the Western Ohio Railway, was killed in a collision between a freight car and a limited car on that road a few days ago. The deceased was twenty-six years of age, and had worked up from a minor clerical position. He was being considered for appointment to the position of auditor to succeed Mr. J. H. Merrill, whose resignation took effect March 1.

MR. ALBERT BENHAM, assistant superintendent of the Cincinnati Traction Company since 1901, has been transferred to Columbus, to assume the duties of general superintendent of the Appleyard properties, which were sold recently to the Schoepf-Morgan syndicate. Before going to Cincinnati, Mr. Benham was division superintendent of the Pittsburg Railways Company. He will have supervision of about 175 miles of interurban lines.

MR. E. J. RAUCH, formerly general superintendent of the Canton-Akron Railway Company, of Canton, Ohio, has been appointed superintendent of the Columbus, Buckeye Lake & Newark Traction Company and the Columbus, Newark & Zanesville Traction Company, succeeding Mr. A. M. Frazee, who goes to Cloquette, Minn., to superintendent the construction of a large power plant, which will furnish light and power to Duluth and Superior. Mr. Frazee will remain in Newark, Ohio, until June.

MR. H. H. CARPENTER, heretofore general passenger agent of the Western Ohio Railway, has been appointed auditor and purchasing agent of the company, succeeding Mr. John H. Merrill, who, as stated in a recent issue of this paper, has become secretary of the newly-formed Central Electric Railway Association, with headquarters at Indianapolis. Mr. Charles F. Price, who has been advertising representative of the company, has succeeded Mr. Carpenter as general passenger agent. Mr. C. H. Collins, heretofore general freight agent of the Appleyard lines, is now general freight agent of the Western Ohio.

MR. CHARLES H. COX has resigned as general manager of the Lincoln Traction Company, of Lincoln, Neb., to become general manager of the Citizens' Street Railway Company, which was organized a year ago for the purpose of building city lines in Lincoln and interurban roads to connect the city with neighboring towns. Material for track and overhead construction has been ordered, also the cars and motors, and the expectation is that a part of the system will be ready for operation in the fall. Before going to Lincoln Mr. Cox was manager of the Middleboro, Wareham & Buzzard's Bay Street Railway Company, of Middleboro, Mass.

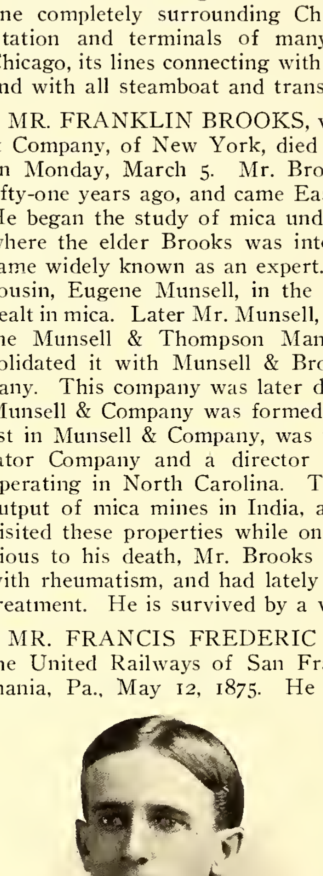
MR. CHAS. H. KILGORE, of Cincinnati, died at his home in that city last week. He was frequently referred to as the father of the street railway and telephone systems in Cincinnati. He built and operated many of the original horse lines in the city, entering the business in 1869. It was under his guidance that the street car lines were first equipped with cable, then electrified, and finally merged into the present system. He was largely interested in the Cincinnati Street Railway Company, the Toledo, Bowling Green & Southern Traction Company and a number of banks, and left a fortune estimated at $5,000,000. For a number of years he had lead a retired life, devoting his time largely to charities.

MR. JOHN F. WALLACE, formerly chief engineer of the Panama Canal Commission, will, in a few weeks, take an important position in the Westinghouse Companies. This step was rumored when Mr. Wallace left the Commission, but the news was very indefinite then, as, indeed, it is to-day. It is understood that a new Westinghouse company is being organized, of which Mr. Wallace will be the president, but the official announcement on the subject is not expected before the end of the present month. Mr. Wallace, before serving on the Canal Commission, was chief engineer of the Illinois Central Railroad, and has always enjoyed a high reputation in engineering circles for his technical ability and attainments.

MR. F. B. HUNTINGTON, vice-president and secretary of the Fond du Lac Street Railway & Light Company, Fond du Lac & Oshkosh Street Railway Company and Eastern Wisconsin Street Railway & Light Company, of Fond du Lac, Wis., has resigned from these companies to become comptroller of the Chicago Terminal & Transfer Company. Mr. Huntington came to Fond du Lac June 1, 1903, accepting a position with the Fond du Lac Street Railway Company as secretary. Soon thereafter he was elected secretary of the Eastern Wisconsin Street Railway & Light Company, and later was elected secretary of the Fond du Lac & Oshkosh Railway Company. Upon the death of F. B. Hoskins, recently, Mr. Huntington was elected secretary and vice-president of all three companies. Before becoming connected with the Fond du Lac Company Mr. Huntington was claim adjuster of the Wisconsin Central Railroad. The company with which Mr. Huntington has become associated has a belt line completely surrounding Chicago, owns the Grand Central Station and terminals of many of the other roads entering Chicago, its lines connecting with every railroad entering Chicago, and with all steamboat and transfer lines.

MR. FRANKLIN BROOKS, vice-president of Eugene Munsell & Company, of New York, died at his home in Elizabeth, N. J., on Monday, March 5. Mr. Brooks was born in San Francisco fifty-one years ago, and came East with his parents when a child. He began the study of mica under his father in North Carolina, where the elder Brooks was interested in mining, and soon became widely known as an expert. He associated himself with his cousin, Eugene Munsell, in the firm of Munsell & Brooks, and dealt in mica. Later Mr. Munsell, Mr. Brooks and others purchased the Munsell & Thompson Manufacturing Company, and consolidated it with Munsell & Brooks as Munsell, Rollo & Company. This company was later dissolved and the firm of Eugene Munsell & Company was formed. Mr. Brooks, besides his interest in Munsell & Company, was vice-president of the Mica Insulator Company and a director in two mica mining companies operating in North Carolina. The firm is also interested in the output of mica mines in India, and a few years ago Mr. Brooks visited these properties while on a trip around the world. Previous to his death, Mr. Brooks had been ill for several months with rheumatism, and had lately gone to Summerville, S. C., for treatment. He is survived by a widow, a son and two daughters.

MR. FRANCIS FREDERIC BODLER, master mechanic of the United Railways of San Francisco, Cal., was born in Germania, Pa., May 12, 1875. He received his early education in the public schools of that town and later attended the Mansfield State Normal School, from which he graduated in 1894 to enter Lafayette College at Easton, Pa. Here he took the course in electrical engineering, employing his time during vacations working as general repair man in a smithy in his native town. Graduating in electrical engineering in the spring of 1898, he was offered and accepted a position on Oct. 10 of the same year, as general repair man of the New Jersey Street Railway Company, and was steadily advanced through the company's testing and armature winding departments to the position of chief clerk and assistant master mechanic. On Sept. 1, 1901, he was offered and accepted the position of master mechanic of the Jersey City, Hoboken & Paterson Street Railway, and on Jan. 1, 1902, he became master mechanic of the North Jersey Street Railway Company's system, with headquarters at Newark, N. J. In August, 1902, he was appointed master mechanic of the United Railways of San Francisco, Cal., which position he still holds. Mr. Bodler is a member of the American Street and Interurban Railway Engineering Association, and has been instrumental to a large extent in building up and maintaining the efficient street railway service which the city of San Francisco now possesses.



F. F. BODLER

Street Railway Journal

VOL. XXVII. NEW YORK, SATURDAY, MARCH 17, 1906. No. 11.

PUBLISHED EVERY SATURDAY BY THE

McGraw Publishing Company

MAIN OFFICE:
NEW YORK, ENGINEERING BUILDING, 114 LIBERTY STREET.
BRANCH OFFICES:
Chicago: Monadnock Block.
Philadelphia: Real Estate Trust Building.
Cleveland: Cuyahoga Building.
London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York"; "Stryjourn, London"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada, Mexico and the Canal Zone.

Street Railway Journal (52 issues)............................$3.00 per annum
Single copies .... 10 cents
Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August & November) $4.00 per annum
Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy).......................$6.50 per annum

To All Countries Other Than Those Mentioned Above:
Street Railway Journal (52 issues), postage prepaid.................... $6.00
25 shillings. 25 marks. 31 francs.
Single copies ....20 cents
Remittances for foreign subscriptions may be made through our European office.

NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the STREET RAILWAY JOURNAL.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires.

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal, 8000 copies are printed. Total circulation for 1906 to date, 90,300 copies, an average of 8209 copies per week.

The Co-operation of Electric Railway Men

Nothing probably has contributed more to the rapid advance in electric railway progress than the general characteristic of all engaged in the work to give the benefit of their experience to others, and to receive from others and test for themselves ideas which promise to be labor-saving. Each one concerned seems to recognize the fact that the other fellow may have an idea better than his own, and he is always willing to give it a trial. On the other hand, if he has worked out some method which seems better than that used elsewhere he is willing to have others acquainted with it. The fact that almost every street railway system has geographically a field of its own, and that an account of its methods will not lessen its receipts may, of course, be one reason that permits of this free exchange of ideas in street railway work. Whatever the cause, we are glad to record this condition as one of the pleasant features of journalistic effort in the electric railway field.

This tendency, which is so prevalent among street railway men, is in marked contrast to the narrow-minded policy in some other lines of work. In many places of business, it is the custom to keep as secret as possible any new method for cheapening the cost of production. To expose any good idea means that another company will gain an advantage, and will thereby be enabled to undersell. Such lack of co-operation can result in nothing other than a slow general advancement of improved methods.

The readiness to give valuable information is not the only evidence of the esprit du corps among electric railway men. There is a marked fraternal feeling among employees of electric railways. The officers of one system have a warm sentiment for officers of any other line. The same is true among the shop men and train men of different systems, and no doubt it is the sense of fraternalism that is at the foundation of the tendency of railway men to exchange ideas. At any rate, whatever may be the cause, it is a most desirable trait, and should be fostered and encouraged so that the rapid advancement and improvements in street railway management and operating details may continue.

Unnecessary Weight of Cars

The designers of electric cars are often apt to consider themselves free from one restriction usually placed on designers of apparatus in general. This is the question of weight. There is a general tendency among railway men to believe that the heavier the car the stronger it is, and the more able to stand up in case of collision or accident. In consequence, the designer is not usually restricted to a certain weight when laying out a car of a given length. If it were true that the heavy car is always the strongest, we should be justified in giving the designer such license. But it is not. Material may be put in the car at points where it is entirely useless and, again, it may be neglected in places where heavy construction is most needed.

Placing no restriction on the designer does not force him to consider closely the requirements of different portions of the car, and he is more likely to be governed by the prevailing practice rather than by actual needs. In order not to err on the wrong side, he probably makes the separate parts a little heavier than usual, and in this manner the "prevailing practice" from which he obtains his ideas leads in the direction of heavier cars.

Of course, the first cost of the car increases with the weight, but this is an insignificant item compared with the expense of hauling unnecesary weight around throughout the existence of the car. This expense, if computed in cents per pound per year or in some other definite manner, would no doubt show the importance of excluding every pound of unnecessary weight. It might also show the advisability of adopting more expensive material, and of increasing the cost of the car considerably in order to reduce the weight. There are some places where aluminum could be used instead of iron or brass, and figures might indicate that it would pay to do so. In many places about the car where cast iron is used cast steel could be substituted, and the weight thus reduced considerably. Ornamental fittings throughout the car might be made of simpler design. Probably, if effort was directed toward this end, the electrical equipment could be reduced in weight considerably. This has already been done with the rheostat, as the weight of the new grid type of resistance is less than one-half that of the old style.

A determined effort to reduce the weight of a car without decreasing its strength, would probably show a number of places where reductions could be made. The decrease in weight obtained at each point might be so small as to seem trivial, but the total reduction would most probably result in quite a lessened current consumption during the year, or certainly during the ten years or more at which the life of the car is estimated. There would also be a corresponding reduction in the wear of the track and wheels.

The Catenary in Direct-Current Work

Some months ago we took occasion to suggest that inasmuch as catenary suspension has given so good an account of itself in high-tension trolley construction it was worth trying for direct-current high-speed roads. We are glad to record that in at least two instances this has been done. The Utica & Mohawk Valley Railway Company put up catenary suspension for direct-current operation on the West Shore Cut-off, between Frankfort and Herkimer, and in our last issue some particulars are given of its employment by the New Orleans Railway & Light Company, in an extension to one of the race tracks. In the case of the West Shore Cut-off the choice was made because the line probably will be operated eventually with single-phase motors, but the New Orleans Company deliberately put up the catenary for the sole purpose of seeing what it would do. We are strongly of the impression that this marks the beginning of a decided tendency in the direction of applying the newer construction to ordinary direct-current railroading, especially where speeds above 30 miles an hour are planned.

We have frequently pointed out that progress in electric traction has been so rapid within the past decade that in the general evolution many important phases of the work have seemingly lagged somewhat behind. One can hardly inspect any of the modern electric railway installations without being forcibly impressed with the fact that there are still left many incongruous reminders of the early days of the art. This remark, perhaps, may be applied with especial emphasis to the overhead construction. To be sure, the trolley wire has been increased in size to accommodate the heavier currents required, and grooved wire has made itself conspicuous, but speaking in general and for the average road, current is still being delivered to the motors in about the same way as it was ten years ago. The only radical development in overhead practice has been the application of the catenary to high-tension installations.

Now that methods of overhead construction are receiving some of the attention which their importance deserves, why not keep up and press this matter to some kind of a conclusion? We understand that catenary construction has proved very satisfactory from an operating standpoint and especially has eliminated troubles caused by trolley wheels leaving the wire and damaging the overhead construction. The remaining questions are those of appearance and cost. As to appearance there might be some objection to the construction in city streets on account of the larger number of wires, although when the reduction in span wires is considered we doubt whether the difference would be considerable. As to cost the testimony from the West Shore Cut-off and from New Orleans is that in these particular instances the catenary was more expensive than ordinary construction. But in neither of these installations has full advantage been taken of the longer spacing between poles that the catenary makes possible. On the West Shore Cut-off the poles were spaced 80 ft. apart, and although the longer spacing of 100 ft. was used on the New Orleans extension there is little doubt that with poles the supports can be placed 150 ft. or 200 ft. apart, and that with supporting bridges spans of 300 ft. can be used. This, in fact, is proposed on the New Haven road and West Shore extensions.

The Dalrymple Report

The famous report on the Chicago situation by Mr. Dalrymple, of Glasgow, which has been so long suppressed by Mayor Dunne, was made public at a meeting of the Chicago City Council on Monday evening, against the protests of the Mayor. The report in full is published elsewhere in this issue. A study of this much-discussed document will show the reasons which led the Mayor to object to its publication. Mr. Dalrymple's views correspond very closely with those expressed in the interview with him soon after his return from Chicago, and published in the STREET RAILWAY JOURNAL for Aug. 5, 1905. They are stated in no uncertain language. The following are some significant sentences:

"There would be grave danger in your city attempting to operate without radical change in the methods usually employed in carrying on municipal work by the cities of the United States."

"I should be very sorry, were you forced to take such a step, as, speaking generally, I should say, from my knowledge and experience of what it means to operate a municipal street railway system, that the municipalities of the United States are not yet quite ready to successfully undertake this work."

"The success or failure of the undertaking depends in a very large measure on the manner in which the general manager carries out his duty. You will, no doubt, see that it would be impossible to secure the best man for the position unless he has an agreement over a period of years and is made entirely independent of all changes in the City Council. The City Council should give the general manager complete control of the whole staff. He should be held personally responsible for the good conduct of those under him. He should be absolutely free to engage and discharge his men."

All will admit the correctness of these statements, but what would be the use of a municipal system to the average politician if it was divorced absolutely from politics? Who is so blind as to believe that a municipality in this country would follow the same methods as a private corporation in the selection of a manager; that it would scour the country to find the "best man for the position," or that, having installed him, would allow him to be absolutely free to engage and discharge his men? Where would the ward bosses come in, if they could not get lucrative jobs for their men, and what encouragement would there be for delivering the goods on election day?

We cannot close our comments upon Mr. Dalrymple's report without congratulating him also upon his remarks on the trolley system as compared with the underground conduit. Independently of whether the roads in Chicago are to be operated by the municipality or by a private company, he says, unhesitatingly, that no other system should be thought of at the present time than the overhead trolley. "If properly constructed it is not unsightly, it is not dangerous, it is the most reliable and it is the most economical, both to construct and maintain. To install the underground trolley to any extent would, for various reasons, be a scandalous waste of money."

The report of Mr. Dalrymple comes with especial force at the present juncture when, by the decision of the United States Supreme Court, the ninety-nine-year franchises are held invalid. This latter declaration clears the horizon and makes some kind of a settlement of the franchise situation in Chicago necessary. The citizens of that city have now had the opinion of the manager of the largest and most successful municipally operated street railway in the world. They have also had considerable experience with the shifting and devious ways pursued by the average municipal officer. If they still persist in endeavoring to establish a municipal street railway system in Chicago they will have no one to blame but themselves.

The High-Voltage Trolley

One of the striking features of European single-phase practice is the tendency toward higher trolley voltages, compared with which 3300 volts seems low. The early roads, like the Stubaithal, were installed with a 2500-volt trolley. This was increased on the Blankenese, and one or two other roads, to 6000 volts to 6600 volts. Then followed the Swiss installation of the Oerlikon Company, described in a recent issue, of 15,000, and the Siemens-Schuckert Company is now experimenting with 20,000 volts for use on the Swedish Government Railways. Nor have direct-current advocates been silent on this question of high voltage. Mr. Sprague's belief in the practicability of 1500 volts is well known, and Max Deri, a prominent European designer and engineer, has gone on record in favor of the practicability of building a d. c. motor of the interpole type which could be operated on voltages between 2000 and 3000.

It is not our purpose here to discuss the relative merits of these different proposals, but to point to the marked tendency toward much higher trolley voltage both in a. c. and d. c. systems, and also to direct attention to two points in the 15,000-volt system of the Oerlikon Company, which has been in operation long enough to demonstrate its feasibility. One is that both the Ward-Leonard scheme of conversion to d. c. on the locomotive, and the regular commutated single-phase motor construction have been given steady work, and that neither locomotive, despite the high voltage used, has given any trouble in the matter of insulation. The other is, that though the Ward-Leonard locomotive would appear to involve very considerable extra weight, it is an open question whether, with thoroughly modern design of the d. c. apparatus and a given draw-bar pull and speed, the weight of a commutating single-phase equipment would not be nearly as great. We earnestly hope that comparative data from these two types of locomotive may ere long be published. Such result would throw a great deal of light upon the questions of heavy electric traction now before the house, and until we do get them, or the first of the N. Y., N. H. & H. locomotives starts up, we shall still have to rely on computations and guarantees.

The successful use in Switzerland of 15,000 volts on the trolley wire, is a sufficient demonstration that the employment of such voltage is not open to any very grave objections. The catenary construction, with long spans from the bridges, seems to ensure a very reliable system of working conductors. Collection of current at high voltage no longer has any special terrors for the engineer, and with the small current required, it becomes entirely feasible to work very long sections of road from a single power house, and the cost of the distributing system becomes absurdly small. One power station per hundred miles of line is then entirely feasible, while using the trolley wires alone for the transmission, and the operation of a long line from hydraulic powers becomes a comparatively simple matter. Without passing beyond line pressures now known to be entirely practicable, one could thus operate the whole New York Central system from New York to Buffalo, without burning a pound of coal for motive power. It may be many a year before this feat is seriously undertaken, but the days of low voltage are surely numbered. It will not be so very long before we are looking back upon them as upon the atmospheric engines of a century ago. A few daring experiments will show the way, and then the world will fall into line as it has many a time before "when the thing that couldn't happen has occurred." The use of hydraulic power for transportation is an end greatly to be desired, for the world needs the coal, what is left of it, for other purposes—keeping warm, for example. At the present rate of consumption, it will not take many years to put the price of fuel where it will have to be used very sparingly. It is, therefore, particularly interesting to record anything that can delay a day so uncompromisingly cheerless. With the Oerlikon experiment going on, and with the tests with high voltages now being conducted for the Swedish Government, it looks as if the Continental engineers were keeping up their end of the good work. Another year will certainly bring a rich store of experience in the performance of single and three phase locomotives. It has taken some years of experiment to work up to this point, but progress hereafter should be more speedy.

OAKLAND TRACTION CLUBROOMS

The Oakland Traction Consolidated, of Oakland, Cal., whose repair shops were described in the STREET RAILWAY JOURNAL for Feb. 3, has fitted up for its employees one of the handsomest suites of clubrooms that is to be found anywhere in the country. The rooms are for the exclusive use of employees of the company, as well as of its allied corporation, the San Francisco, Oakland & San Jose Railway (operating the Key Route System), and that they are appreciated and enjoyed by the men is shown by the successful club which has been formed to maintain the quarters and by the popular patronage which the rooms receive.

FIG. 1.—OFFICE AND CLUB ROOMS IN THE GENERAL OFFICE BUILDING

The clubrooms are located in the company's general office building on San Pablo Avenue, Twenty-First Street and Grove Street, and occupy the entire second floor and a portion of the ground floor. This building, Fig 1, is of a substantial brick construction, and was built and occupied for a number of years as a cable power house and car house. The cable plant was abandoned when the San Pablo road was changed to an electric line.

When the combined properties of the Oakland Traction Consolidated required larger offices, part of the ground floor of this building was fitted up for that purpose. This left the entire upper part of the building unoccupied, and when the idea of a clubroom for the men was broached by General Manager Kelly, this space was available, and it has proved to be very suitable. To one acquainted with the building in its original form, the transformation that has taken place seems remarkable. An entire floor had to be put in for the second story, partitions and stairways were added, the walls were cleaned, and finally suitable finishes were put on floors, ceilings and walls. As mentioned above, W. F. Kelly, general manager of the company, fathered the idea, while J. Q. Brown, assistant general manager, with the aid of H. L. Griswold, his assistant, designed and supervised the construction. The entire suite of rooms was fitted up and furnished and equipped by the company at its own expense, and then turned over to the employees for their benefit, to use and maintain without payment of rent or other charges.

For this purpose the men formed the Oakland Traction Club, starting off at the first of 1905, when the rooms were first occupied, with 200 members. Membership to the club is limited to employees of the Oakland Traction Consolidated and the Key Route System, and all employees from any of the divisions or departments are admitted on the same basis. The club elects its own officers, and is not dictated to or influenced in any manner by the officials of the company. Starting with perhaps some prejudice from a few, the club has had a substantial and satisfactory growth—satisfactory not only to the company, but to the men themselves. The members now number 360 out of a total of 1000 employees. That the proportion is not far greater is accounted for by the fact that some of the division headquarters are at present located some distance from the rooms. However, when the company completes the new car houses which it is now erecting in a central location in East Oakland, a larger number of men will be able to take advantage of membership in the club and of the use of the rooms.

A membership fee of $2 is charged for admittance to the club, and the monthly dues are 50 cents. For these fees, a member of the club is entitled to the full use of the rooms and gymnasium. The only additional charge is one of 5 cents per game for the use of the bowling alleys.

The present officers of the Oakland Traction Club are as follows: President, Charles E. Parsons; vice-president, George St. Pierre; treasurer, George Williams; secretary, C. W. Graham. The directors are chosen one from each division. The different features of the club's affairs are managed respectively by a house committee, an entertainment committee, a finance committee, an auditing committee and a bowling committee. The bowling committee has charge of the alleys and manages a tournament, each division and each department having a team, eight in all. Prizes are offered for the successful teams.

FIG. 3.—A VIEW OF THE BOWLING ALLEYS

There are five men regularly employed to do the janitor service, tend to the cigar stand, bowling alleys, etc. In addition the club's secretary is given a small salary for attending to the club's clerical business.

Entrance to the clubrooms is obtained from Twenty-First Street through a spacious hallway, in one corner of which is a cigar stand, where cigars and tobacco are sold at standard market prices. No liquors are sold or allowed in the rooms. The cigar stand is maintained by the club and the profits are turned into the club treasury. Fig. 2 is a view of the entrance hall looking toward the cigar stand.

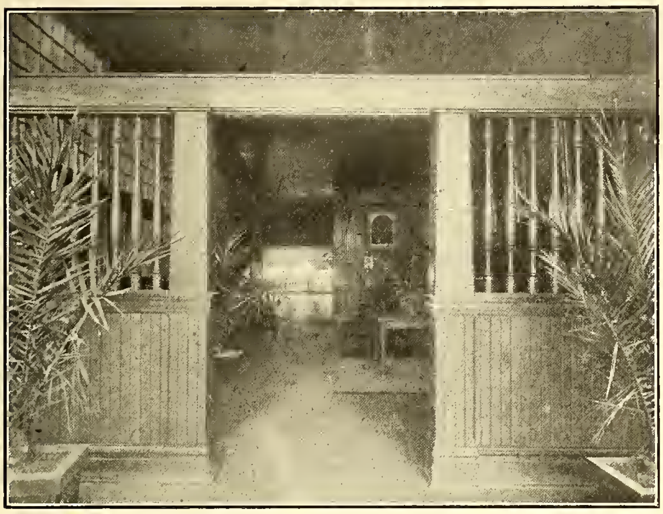


FIG. 2.—ENTRANCE HALL TO THE CLUB ROOM

Beyond this hall is the bowling alley room, where two good alleys are installed. This room was formerly used for the cable drive of the old cable power plant, and its length, 250 ft., was therefore more than sufficient for its new use. That the room is an excellent one for bowling may be judged by the illustration, Fig. 3.

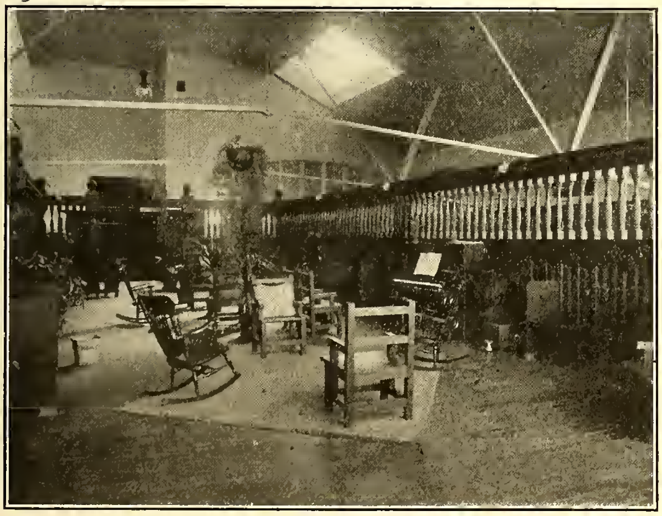


FIG. 5.—ASSEMBLY ROOM OF THE OAKLAND TRACTION COMPANY'S CLUB ROOMS

Leading from the entrance hall to the second floor is a broad, easy stairway, opening on the upper floor into a reception hall, Fig. 4. The second floor has an area of 150 ft. x 150 ft., all of which is devoted to the uses of the club. Directly beyond the reception hall is the assembly room, Fig. 5, which is comfortably furnished with chairs, settees, tables and a piano, the last purchased by the club. To the right of the assembly room in the northwest corner is the reading room, Fig. 6, where on a spacious table are arranged the thirty or more magazines, journals and papers which the club subscribes for or receives gratuitously. The scientific and technical publications are preserved for filing and binding, while the popular magazines, after they have been read, are given to the different hospitals in Oakland. Writing tables, provided with the club's stationery, are conveniently located in this room.

Next to the reading room and opening off the assembly room is a card room, where four tables are provided for cards and other table games.

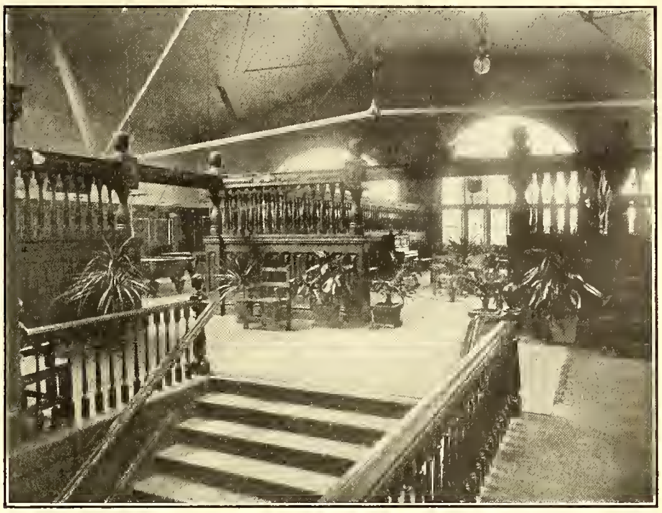


FIG. 4.—THE ENTRANCE TO THE RECEPTION HALL

Extending along the south side of this half of the building is the billiard room, Fig. 7, where three pool and billiard tables, furnished by the company, serve to keep many of the men busily engaged during their leisure moments. The room is well lighted, and comfortable settees are arranged along the sides.

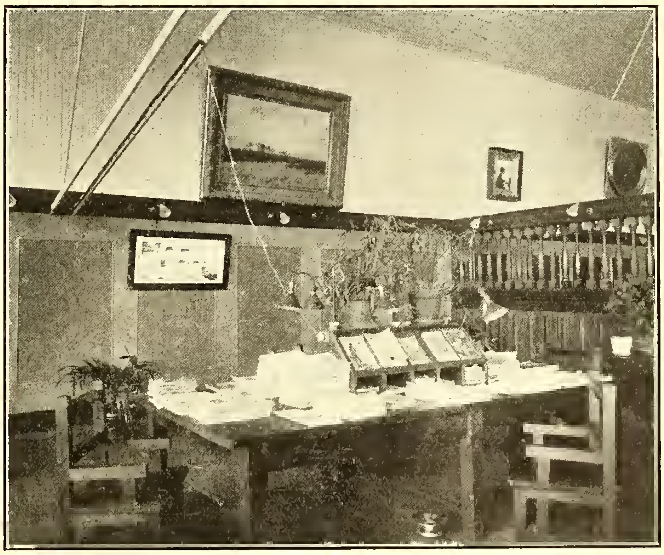


FIG. 6.—THE READING ROOM. THE LARGEST STACK OF PAPERS IS COMPOSED OF "STREET RAILWAY JOURNALS"

At the right of the reception hall is an instruction room, Fig. 8. The walls are hung with charts illustrating the design and operation of the air brake. Regular instruction is given here to new men.

The rooms described above are all located in the west half of the second story of the building. They are finished in Oregon pine and stained a dark brown, which gives a handsome and rich appearance. The floors are stained to correspond and the walls are paneled and covered with burlap of a tone harmonizing with the whole. The Old Mission style of furniture has been adopted throughout, and a generous supply of palms, ferns and other plants typically Californian, serve to give the rooms a semi-tropical and withal a very pleasing and homelike appearance. The walls are hung with some handsome works of art, loaned by directors of the company. The partitions are heavy and open pillared at the top, the construction being of a pleasing Colonial style.

FIG. 7.—BILLIARD ROOM IN THE OAKLAND TRACTION COMPANY'S CLUB ROOMS

The entire eastern half of the second floor is occupied by the gymnasium, lockers, lavatories and baths. The gymnasium is a large, airy room, as may be seen from Fig. 9. It is equipped with vaulting horses, ladders, weight machines, ropes, dumb bells and clubs, wrestling mats, boxing gloves, punching bags, Roman rings, etc. Four shower baths are provided and 350 lockers, sufficient for all the members, no extra charge being made for the use of either bath or locker.

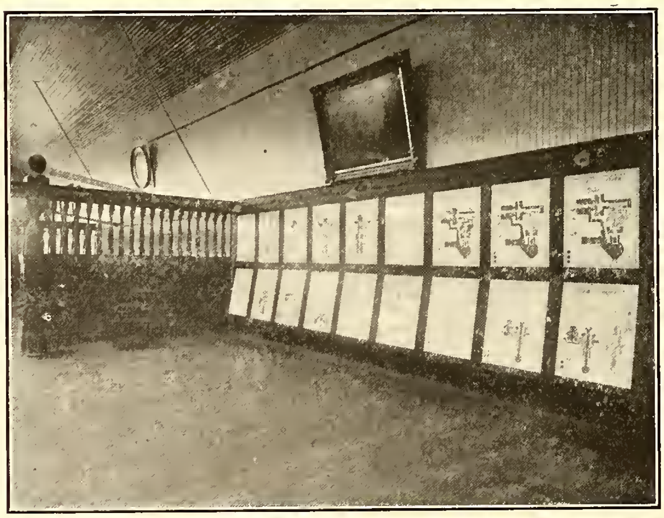


FIG. 8.—INSTRUCTION ROOM

Even considering the considerable expense to which the company was put in building, equipping and furnishing the rooms, the officers feel that the investment was an exceedingly profitable one, as not only has a kinder and more unselfish feeling been engendered among the employees toward the company, but a decided improvement has been noticed in its efforts to secure and keep in service conscientious and efficient men. The men appreciate the broad-gage policy so substantially shown by the company, and have more desire to work for its interests and welfare. In short, the clubrooms are a success and are proving profitable alike to employees and employers.

Acknowledgment is hereby made to F. W. Frost, assistant secretary, and J. Q. Brown, assistant general manager, for their kindness and assistance in furnishing material and photographs for this article.

SINGLE-PHASE RAILWAY NEAR HAMBURG, GERMANY

Several short articles which have been published recently in the Street Railway Journal, have referred to important electric railway systems proposed or under construction in Hamburg. There are two such enterprises. One is a projected underground and elevated electric railway system within the city. Up to the present the electrical system has not yet been selected, but the contract for the elevated structure will soon be awarded. The other line is a suburban railway, connecting Ohlsdorf, Hamburg, Altona and Blankenese, belonging to the Prussian Government. This line is being equipped with the Winter-Eichberg system of the Allgemeine Elektricitäts-Gesellschaft, and will be opened on Oct. 1, 1906. The power house contract was divided among Brown, Boveri & Co., Siemens-Schuckert Works and Lahmeyer & Co.

The rolling stock of the Blankenese-Ohlsdorf line will consist of 51 two-motor car units. That is, each unit will be composed of two motor cars, each mounted on three axles, and permanently coupled together. There is a single truck under the outer end of each car, and a single running axle under the inner end. The car, which carries the current-collecting apparatus, carries the switches and transformer for the high tension, and has both of its truck axles motor-driven, whereas the second car carries low-tension apparatus only, and has but one of its axles (the outside one) motor-driven. The first car is divided into a motorman's cab, and two third-class and one second-class passenger compartment. The third-class compartment adjoining the motorman's cab has double doors and seats that fold-up, so that it can be used as a baggage compartment, if desired. The second car also contains a motorman's cab, a third-class and a second-class section. Each motorman's cab has a folding seat and is otherwise arranged so that it can be available for passengers when it is at the rear

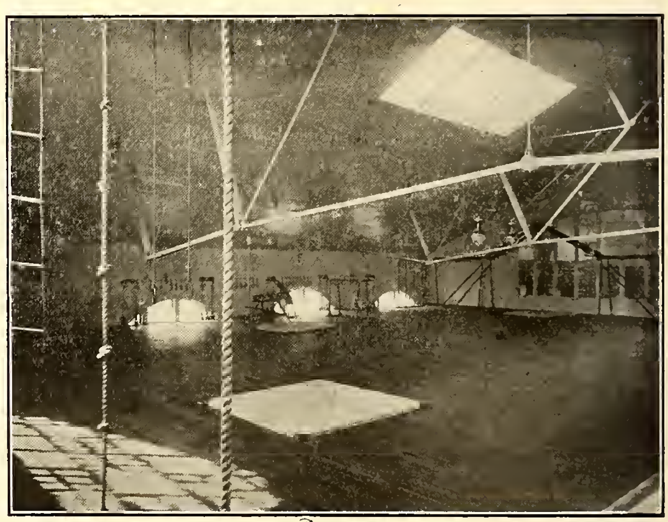


FIG. 9.—INTERIOR OF GYMNASIUM

of the train. The seating capacity is 122 or 124, depending upon the direction of the train. All compartments are furnished with side doors, but there is no communication between the compartments.

The roof is covered with cross-strips of leaded sheet iron, which are connected together, and with the tin covering of the car sides, and are grounded so that a falling high-tension wire will be immediately short-circuited.

The trucks have a wheel base of 2.5 m. (8 ft. 2 ins.) with wheels 1 m. (39.37 in.) in diameter. The Knorr air brake is used. The length of each car is 14 m. (46 ft.), and the width 2.6 m. (8 ft. 5 ins.). The length of the train over all between buffers, 29.55 m. (97 ft.), and total weight without passengers, 71 tons.

On the interurban section the trolley potential is 6000 volts, and the wire is carried at a height of 5.2 m. (17 ft.) over the center of the track in the open and 4.8 m. (15 ft. 9 ins.) under the bridges. At the terminal station the overhead potential is only 300 volts, and the trolley wire is placed 4.5 m. (14 ft. 9 ins.) above and at a distance of 1.2 m. to 2 m. (4 ft. to 6 ft. 6 ins.) from the center of the track. Twenty-five cycles are used.

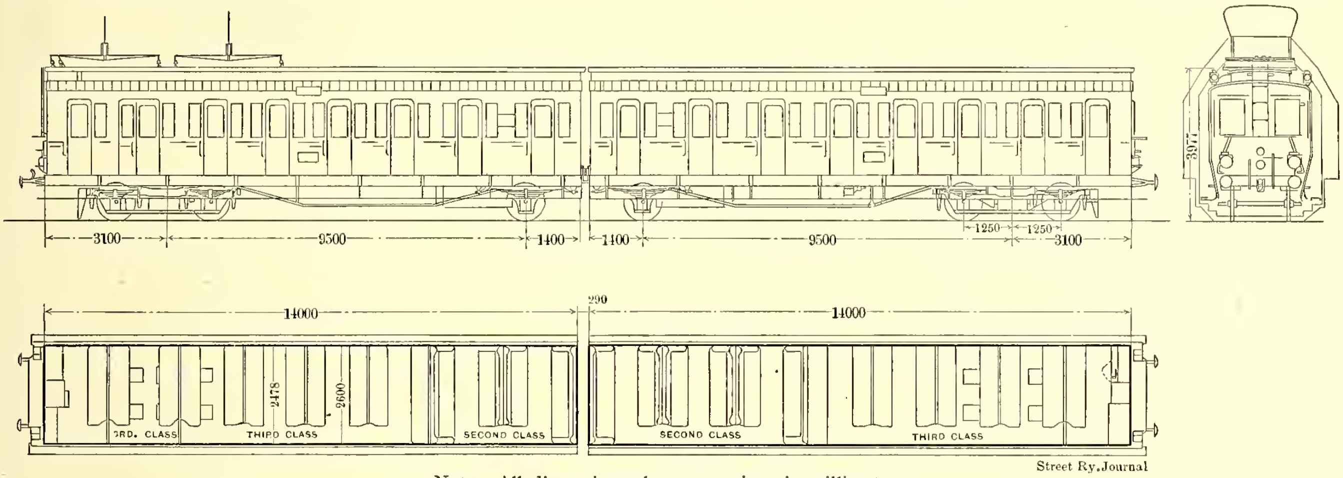
The motors, which are three in number, are of the Winter-Eichberg 51-V type, and are somewhat larger than those used on the Niederschöneweide-Spindlersfeld (See Street Railway Journal for Oct. 17, 1903). Ventilation is secured by taking air in through the hollow axle. In this way it does not come into direct contact with the commutator. There are two sets of brushes, set 90 degs. apart electrically. At a speed of 600 r. p. m., the motors are 115 hp on the one-hour rating. They are designed for 25-cycle single-phase current at 750 volts. One oil transformer is provided on the car for the three motors used. Each group of motors has an oil-exciter transformer, whose taps are arranged for five running positions.

The control system used is of the Allgemeine Company's multiple-unit contactor type, so that any desired number of these motor trains may be coupled together and operated from one master controller. There is also a special contactor for the electric heaters, which is brought into the circuit when the master-controller handle is at zero, and, therefore, when no current is going to the motors.

A voltage of 300 is used on the trolley wire in the depots at the ends of the line, as stated, and these wires are lower than those on the interurban portion. When the overhead collectors change from the proper height for the high-tension wires to the proper height for the low-tension wires, a commutating switch which is connected pneumatically and electrically with the collectors, changes the connections of the motors from the transformer to the trolley wire direct. The high-tension collectors have sliding contacts of aluminum, while the low-tension collectors are of the roller type. The low potential collectors are short and can never spring high enough to come in contact with the high-tension wire. The lighting current is obtained from a 300-volt tap on the power transformer. The lamps are of 16 cp and 25 cp, are made for 48 volts and are placed four in series. As the 16 cp and 25 cp lamps are in separate circuits, the burning out of a lamp on one circuit will not affect those on the other. Owing to the possible variations in voltage, five steadying resistances are introduced in each lamp circuit. There are also four 150-volt, 16-cp signal lamps, placed in two series, and one petroleum signal lamp.

The heating current is also taken from a 300-volt tap on the power transformer. Every compartment, except the baggage and motormen's, has a 2-kw and a 1-kw heater arranged in parallel, hence three degrees of temperature can be secured. Current is taken by the heaters only when the motors are not taking current.

The compressor is operated by a 300-volt 3-hp a. c. motor, and to prevent vibrations of the car floor, is mounted on the one-motor truck.



Note.—All dimensions shown are given in millimeters.

PLAN OF THE EXPERIMENTAL CAR FOR THE BLANKENESE-OHLSDORF SINGLE-PHASE RAILWAY

ELECTRIC RAILROADING IN MANILA IS A SUCCESS

The Manila Electric Railroad & Lighting Corporation, which operates all the electric railways in Manila, aggregating 40 miles of track, reports for the four weeks ending March 7 gross earnings of $37,025. This is an increase at the rate of about 10 per cent. a month. It will be remembered the road was built complete and is operated by J. G. White & Company, of New York City.

The Trenton Street Railway Company has reduced the fare between Trenton and Princeton from 15 to 10 cents, for the 12 miles. As tickets are sold at the rate of six for a quarter, the fare is really reduced from 12½c. to 8 1-3c., or only 4 1-6c. for the 7 miles from Trenton to Lawrenceville. Prior to 1902 the fare was 20c. each way between Trenton and Princeton. The Trenton, Lawrenceville & Princeton Railroad (New Jersey & Pennsylvania Traction system) reduced the rate to 10c. for the 13 miles it covers, and the Trenton Street Railway has made the two reductions since.

EARNINGS OF ELECTRIC RAILWAY COMPANIES

BY WYATT W. TAYLOR

A comparison of the earning and cost of operation of the electric railways in the United States has recently been compiled by the writer, from figures given in the report of the United States Census Bureau for the year ending June 30, 1902, and recently published. The States are classified geographically, so that figures for contiguous States can be more easily compared. The differences in the various items, when so classified, are extremely interesting. Thus, the table shows that in the percentages of operating expenses to gross receipts, the New England roads are all much above the average for the United States, whereas in the Central group most of the states are under the average, and the highest is not as high as the lowest in the New England States. A comparison of net earnings per car mile shows also great differences. Minnesota is highest, with Wisconsin next. In gross and net earnings per mile of track New York and Louisana lead, undoubtedly owing to the large preponderance of city track. The "fare passengers per car mile" do not vary as much as most of the other figures, and with the exception of Kansas, New Jersey, Rhode Island, Montana and Washington, are all between 2.98 and 4.89. Other interesting comparisons can be drawn up from the table but need not be discussed here.

STREET AND ELECTRIC RAILWAYS.—TABLE OF YEARLY EARNINGS AND COST OF OPERATION. COMPILED FROM THE U. S. CENSUS REPORT OF 1902, ON STREET AND ELECTRIC RAILWAYS

STATE OR TERRITORY.	Number of Companies.	Gross Earnings.	Percentage of Operating Expenses to Gross Earnings.	Car Mileage.	Gross Earnings per Car Mile.	Net Earnings per Car Mile.	Fare Passengers per Car Mile.	Length in Single Track Miles.	Gross Earnings per Mile of Single Track.	Net Earnings per Mile of Single Track.	Fare Passengers per Mile of Single Track.	Percentage of Maintenance of Way to Total Operating Expenses.	Percentage of Maintenance of Equipment to Total Operating Expenses.	Percentage of Operation of Plant to Total Operating Expenses.	Percentage of Operation of Cars to Total Operating Expenses.	Percentage of Miscellaneous Expenses to Total Operating Expenses.
NEW ENGLAND STATES.		$			Cents	Cents			$	$						
Maine	19	1,542,508	73.1	6,815,671	22.6	6.1	3.99	330.40	4,668.60	1,255.60	76,897	12.9	14.0	17.8	33.5	21.8
New Hampshire	7	604,131	79.2	3,214,879	18.8	3.9	3.52	174.45	3,469.90	725.00	67,432	7.4	10.2	28.0	34.0	24.0
Vermont	9	249,228	80.7	1,412,528	17.6	3.4	3.32	86.05	2,896.30	558.40	53,070	13.0	10.0	20.7	45.2	11.1
Massachusetts	74	23,617,570	69.5	101,373,975	23.3	7.1	4.61	2,578.42	9,159.70	2,797.80	182,822	9.2	11.6	15.7	45.5	18.0
Rhode Island	7	2,964,260	63.8	12,296,893	24.1	8.7	5.12	350.35	8,460.90	3,059.20	189,356	15.0	11.3	15.6	41.8	16.3
Connecticut	21	4,284,089	64.7	20,186,690	21.2	7.5	3.93	593.43	7,219.20	2,545.30	134,194	11.9	10.5	15.8	40.2	21.6
EASTERN STATES.																
New York	96	59,315,606	56.8	251,312,176	23.6	10.2	4.89	2,889.10	20,530.80	8,874.00	407,305	7.1	11.2	15.6	46.0	20.1
New Jersey	25	8,137,477	53.1	35,372,346	23.0	10.8	5.35	872.96	9,321.70	4,368.30	219,414	6.3	13.3	17.6	44.2	18.7
Pennsylvania	98	30,319,211	51.5	133,501,699	22.7	11.0	4.83	2,542.07	11,927.00	5,780.50	258,983	9.9	13.1	13.2	46.5	17.3
Delaware	3	500,412	72.0	3,006,798	16.6	4.6	3.35	89.66	5,581.20	1,559.50	116,301	3.2	9.7	23.5	37.4	26.2
Maryland	10	4,898,627	47.2	24,832,662	19.7	10.4	4.13	456.63	10,727.80	5,675.00	228,370	5.2	12.3	20.0	44.0	18.5
Virginia	16	1,553,478	65.0	12,335,072	12.6	4.4	3.60	378.30	4,106.50	1,438.40	127,562	9.3	9.8	24.1	31.7	25.1
West Virginia	8	1,102,171	59.2	6,734,171	16.4	6.7	3.22	93.64	11,770.30	4,798.30	155,049	7.5	7.4	15.0	42.6	27.5
CENTRAL STATES.																
Michigan	24	6,494,691	56.3	33,046,839	19.7	8.6	3.52	1,083.11	5,996.30	2,529.10	111,376	8.8	11.6	18.0	42.8	18.8
Ohio	62	16,587,693	55.1	83,996,438	19.7	8.8	3.43	2,454.83	6,757.20	3,045.10	121,284	8.6	9.5	17.8	46.0	18.1
Indiana	26	3,813,076	58.2	24,095,357	18.1	7.6	3.17	679.47	5,611.80	2,344.90	102,458	8.8	13.8	16.4	38.2	22.8
Kentucky	12	2,932,901	53.2	15,477,507	18.9	8.8	3.64	296.76	9,883.10	4,625.40	198,253	15.1	9.4	11.9	41.9	21.7
Wisconsin	17	3,902,059	51.1	15,609,884	25.0	12.2	4.03	446.14	8,748.50	4,276.50	159,150	6.9	8.3	19.6	36.0	29.2
Illinois	48	24,164,965	58.3	121,142,474	19.9	8.3	3.83	1,713.39	14,103.60	5,872.40	289,035	7.5	14.2	16.7	41.3	20.3
Minnesota	5	3,727 648	46.1	15,692,887	23 8	12.8	4.67	316.27	11,786.30	6,348.90	216,547	5.4	12.9	15.3	45.6	20.8
Iowa	22	2,384,421	61.3	11,809,254	20.2	7.8	3.30	350.00	6,812.60	2,638.30	101,942	10.9	10.7	20.1	35.2	23.1
Missouri	16	10,691,220	56.8	55,762,991	19.2	8.4	3.83	720.78	14,832.80	6,408.60	279,291	6.8	12.8	16.2	44.7	19.5
SOUTHERN STATES.																
North Carolina	7	437,259	73.7	1,676,978	26.1	6.9	3.28	58.76	7,441.40	1,955.60	115,228	9.0	8.7	24.6	24.7	33.0
South Carolina	7	597,577	66.7	2,520,231	23.7	7.9	3.62	77.98	7,663.20	2,550.80	117,651	6.0	8.9	14.0	34.0	37.1
Georgia	10	2,375,224	52.0	10,733,429	22.1	10.6	3.04	308.38	7,702.30	3,706.20	108,076	4.1	8.2	14.4	32.5	40.8
Florida	6	529,743	64.0	2,349,449	22.5	8.1	3.65	61.75	8,578.80	3,082.80	133,596	6.1	7.7	19.2	30.2	36.7
Alabama	9	1,497,351	58.7	6,152,896	24.3	10.0	3.76	204.72	7,314.10	3,023.90	111,122	8.2	13.0	13.0	34.2	31.6
Mississippi	5	258,654	74.3	923,990	28.0	7.3	3.36	25.30	10,223.50	2,632.40	122,570	8.6	7.7	32.2	21.2	30.3
Tennessee	8	1,866,835	57.7	10,138,603	18.4	7.8	3.52	248.53	7,511.50	3,161.00	140.432	9.0	11.7	15.2	38.0	26.1
Louisiana	8	2,910,244	60.4	18,594,869	15.7	6.2	2.98	198.84	16,434.10	7,590.90	278,782	9.3	13.8	16.8	47.3	12.8
Arkansas	7	371,560	58.2	2,144,776	17.3	7.2	3.21	51.33	7.238.70	3,022.20	131,082	8.8	9.0	25.5	40.6	16.1
WESTERN STATES.																
Nebraska	4	1,148,994	57.1	6,273,945	18.3	7.8	3.56	119.56	9,610.20	4,125.70	195,569	18.6	9.7	18.7	40.3	12.7
Kansas	11	370,481	69.4	2,417,364	15.3	4.7	2.83	195.81	1,892.00	578.20	61,406	9.6	11.4	17.3	39.9	21.8
Texas	17	1,547,846	64.2	9,804,017	15.8	5.7	3.08	309.36	5,003.40	1,791.90	99,047	11.2	11.1	17.8	38.0	21.9
Colorado	7	2,227,286	58.4	8,925,060	25.0	10.4	4.75	234.53	9,496.80	3,951.20	183,865	14.4	9.9	18.6	40.9	16.2
Montana	5	492,023	74.2	1,354,822	36.3	9.4	5.22	63.21	7,783.90	2,008.30	108,505	10.7	7.8	16.2	33.5	23.8
Utah	3	561,328	63.6	3,047,222	18.4	6.7	3.77	89.04	6,304.20	2,296.10	123,082	15.3	11.5	16.8	45.6	10.8
Washington	8	2,542,905	62.0	8,378,420	30.5	11.7	5.01	228.93	11,107.80	4,223.50	181,471	11.9	8.6	17.5	32.8	29.2
Oregon	6	1,042,895	62.7	4,781,105	21.8	8.1	3.97	140.48	7,423.80	2,768.80	137,041	10.7	13.2	16.5	44.8	14.8
California	35	9,967,288	54.2	41,512,788	24.0	11.0	4.42	839.95	11,866.50	5,434.90	219,753	9.8	11.4	16.3	51.1	11.4
All other States and Territories.	12	3,021,063	52.2	16,671,311	18.1	8.6	4.06	175.57	17,207.2	8,233.00	383,594	4.4	12.2	18.0	47.5	17.9
United States	799	$247,553,999	57.5%	1,144,430,466	21.6 cts	9.2 cts	4.26	23,134.44	$10,700.70	$4,549.20	212,217	8.5%	11.5%	16.9%	43.2%	19.9%
Hawaii and Porto Rico	5	515,913	64.0	1,913,409	27.0	9.7	5.04	41.26	12,504.00	4,497.50	232,564	6.3	8.4	16.8	33.5	35.0

Note.—All expenses, except dividends and interest on bonds, are included in aggregate of Operating Expenses.

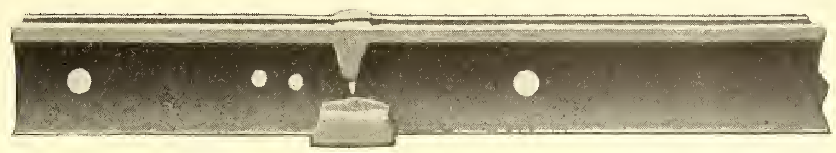
INTERURBANS BUILD UP TOWNS IN INDIANA

According to statistics recently gathered by the State statistician for Indiana, towns and cities connected by interurban railways have made a comparatively greater increase in population and material prosperity than towns and cities having steam road facilities alone. The figures show conclusively that many towns and cities having steam railroads have remained at a standstill for years previous to being connected by electric lines. The report disproves the theory that electric lines are injurious to small towns, from a business standpoint. This is true in the matter of increase in manufacturing as well as local business and increase in population.

A NEW SYSTEM OF ELECTRICALLY WELDING RAIL-JOINTS

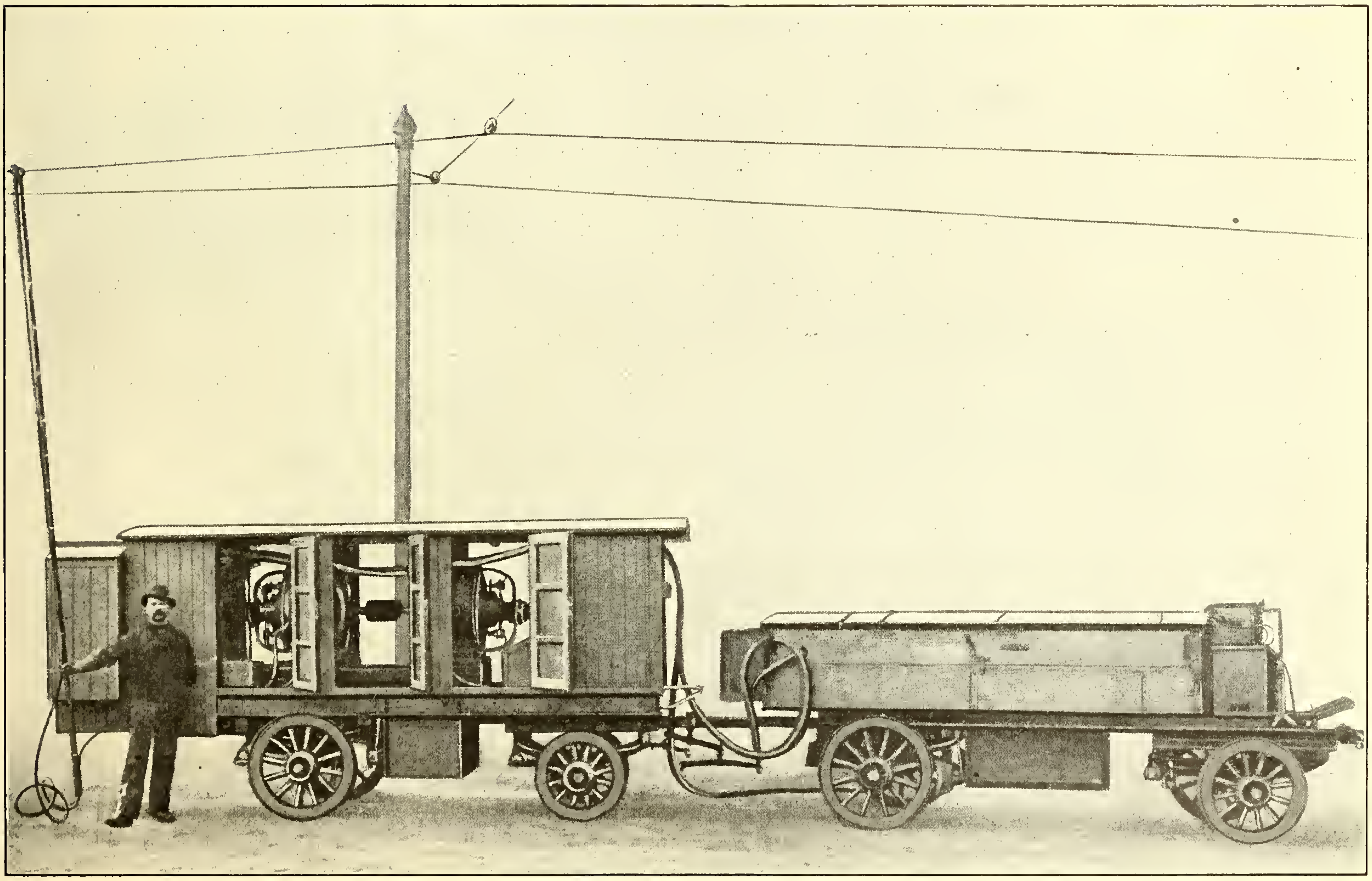
Since the introduction about twelve years ago of continuous rails with welded joints for street railway track, three kinds of welded joints have come into more or less general use in this country and abroad, viz., the Falk, or cast-welded joint; the Lorain, or the joint which is electrically welded by means of current from a transformer, and the Goldschmidt or thermit-welded joint.

A fourth method is now being employed in Germany, and has been adopted on several railways. It is being exploited by the Accumulatorenfabrik Aktiengesellschaft, of Hagen and Berlin, and it is a modification of the electrically welded joints. It does not depend, however, upon the production of a welding heat by the resistance and transformer method, as in the Lorain system. Instead, a high temperature is secured by the use of a large electric arc, which melts a quantity of steel at the point of application, viz., at the joint. The negative pole of this arc is formed by the rails themselves, and the positive pole is a carbon supplied with direct current from a special generator and other apparatus provided for the purpose. The carbon or positive pole is attached to a holder so that it can be moved back and forth by hand over the pieces of steel, which are to be reduced to a liquefied condition at the joint to form the welding portion. During this process the joint itself is held in a form or mold, so that as the metal melts it flows underneath and around the base and under the head of the rail. A small quantity of steel is first melted, and additional steel is fed into the arc until enough has been melted to form the weld. The steel employed is of the same composition as that used in the rail itself, and is obtained from old rails. The system has been employed to a considerable extent for joint welding by a number of the electric railway companies in Germany during the last few years, and has also been applied to welding steam engine cylinders, power shears, broken gears, and for other industrial purposes.



THE JOINT AFTER WELDING

For rail welding, the two vehicles illustrated below are employed. The left hand vehicle contains a motor generator whose motor is connected with the railway circuit, and whose generator supplies direct current at 60 volts, the potential required for the arc. Owing to the great variations in the current which occur during the process, it has been found best to place a storage battery in parallel with the generator or low-tension side of the motor-generator set. This battery is carried in the second vehicle, or the one at the right hand in the illustration, and is connected with the motor generator by cables. Both vehicles are mounted on wheels so that they can stand in the roadway and not interfere with traffic on the tracks, and the flexible connection with the trolley wire for operating the generator can also be removed to allow a car to pass.

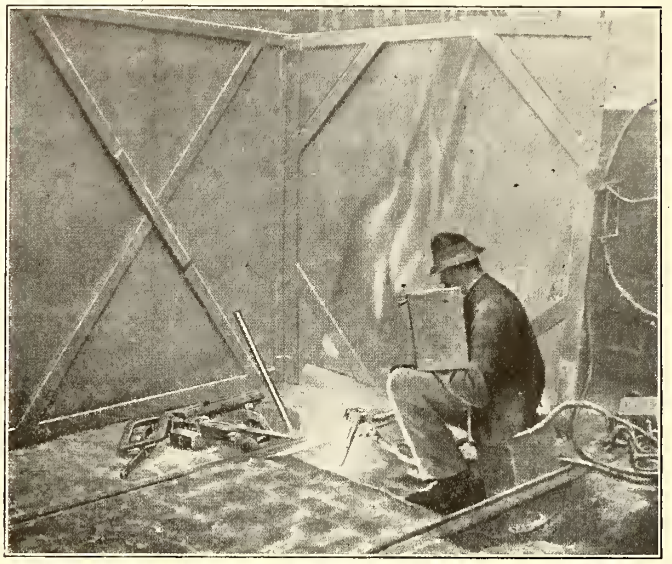


THE RAIL-WELDING OUTFIT, CONSISTING OF MOTOR-GENERATOR AND BATTERY WAGONS

About 30 kw-hours are required to weld one joint on track weighing 50 kg per running meter (100 lbs. per yard).

The first practical application of this method was made on the Hagener Strassenbahn, where about 500 joints were welded during 1903, and during the first three months of

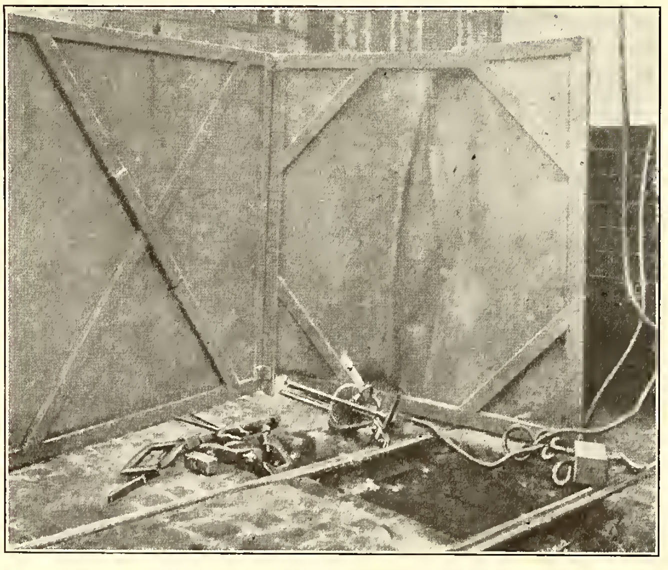
1904. This work was done on old track weighing only 32 kg per running meter (64 lbs. per yard), and which was laid in a moist soil. A number of defects developed in this pioneer installation, as was also the case with certain work which was done a little later in Aachen. The early difficulties, however, were soon overcome, and in the fall of 1904 about



APPLYING THE FLAMING ARC TO THE JOINT

500 additional joints were made in Hagen with much better results than the first time, as only 2 per cent of the joints were broken and a smooth-riding rail was obtained.

In September, 1904, the Grosse Berliner Strassenbahn welded 100 joints on its heavy traffic lines, Strassburg installed 100 in November, 1904, Gladbach 250 in the summer of 1905, and Dusseldorf about 250 in December, 1905. It is reported that on none of these lines have any breakages of these welds



A VIEW OF THE JOINT AFTER WELDING

developed. The longest continuous sections of rails welded did not exceed 500 m. (1640 ft.), but the Accumulatoven Gesellschaft recommends a maximum of 50 m. (164 ft.)

An interesting application of this welding method was made by the Berliner Elektrische Strassenbahn, which uses mitred joints. At ten joints, which had become worn, a piece of rail was cut out and a new piece welded. The resulting elevation of the joint was so great that it became necessary to cut out pieces one meter long before perfectly successful welds could be made.

FROM A CONDUCTOR'S POINT OF VIEW

In several former issues of the Journal articles have appeared from a man employed on one of the large electric railways as a conductor, under the caption, "From a Conductor's Point of View." This man has secured another position that requires him to travel continually about eight or nine hours every day. He has contributed some of his observations, which will no doubt prove interesting.

THE BREAKING IN OF NEW MEN

When a man is appointed to the position of conductor or motorman on a street railway, he is assigned to ride around a certain number of days with an experienced man to learn the duties of that particular position, and it often happens that the making of a good man for either the front or rear of a car is spoiled at the beginning by his teacher not taking the pains or not having the ability to instruct him as he should be taught. When the new man arrives at the depot, he is placed "breaking in" with the first conductor that comes along, without regard to temperament or other qualities. If the new man has never had any experience in railroading, this conductor has what he considers a very unpleasant task. He at once begins to feel sorry that his car is not the one ahead, and his chief ambition in life is to get rid of the greenhorn. As the new man naturally cannot handle the car to perfection, the conductor will only allow him to do as little as possible. He will only permit him to collect fares when there are but a few people in the car, while he will stand on the rear platform and ring the bell. Or he will collect the fares himself and instruct this new man to stand on the platform and ring the bell. On the matter of day cards, he will watch the learner write the numbers, and if a mistake is made he will simply state the numbers to be substituted for those already written, instead of going into details.

While the quickness a conductor student will develop without the aid of an experienced instructor depends, of course, upon his natural aptitude, yet his preliminary instructions should be carefully followed up, and while the real process of "breaking in" commences after this conductor has started to take out runs on his own accord, pains should be taken to instruct him and give him a few points and "wrinkles," as far as it is possible to do so.

The New York management has found that the practice of paying a man during his period of instruction as motorman. and of giving extra pay to those acting as instructors, is an excellent one, and there is no doubt in the mind of the writer that the same policy could be generally adopted to advantage.

REMEMBERING PASSENGERS

It is surprising to notice that there are conductors of eight, nine and ten years standing who do not seem to be able to localize and central their "freight." Thus, suppose their car, with a seated load and several standing passengers, reaches stances is to size up the new passengers as they board the car, The proper thing for the conductor to do under these circumstnaces is to size up the new passengers as they board the car, their height, their sex, and, more particularily, their articles of clothing and where they locate themselves in the car, yet this is a duty that is honored more in the breach than the observance. The conductor should look over people about to board his car, just as a bank cashier examines a roll of bills for counterfeit money; he should, in fact, take a mental photograph of them. To acquire perfection, he should practice looking over his passengers as his car proceeds on its journey. He should start at the door, look at the first man he sees and say to himself, "Where did he board the car?" And so on, whenever he had a chance, throughout the journey.

It is surprising what an instinct will be built into a man by this method. Nothing will be left to chance. He will be able to locate his passengers by system and lose a very small percentage of fares. A new man should be told to practice this, even after he has been on the road some little time. Another point might be mentioned in this connection. When a number of persons board the car together, the conductor should take particular note of anyone that looks like a beat, and should get after his fare the first thing. This would give these people to understand that it was not an easy matter to beat a conductor.

SHOULD PROMOTIONS BE MADE FROM THE RANKS

There are arguments both for and against the placing in an executive office of an employee who has served in a subordinate position. This subject is one that has been discussed time and time again from its sentimental or ethical side, but the business aspect of such a policy has never been taken up in this paper. It is all right to say that a man who has been ten or fifteen years with a company has first claim on the new office to be filled, but from a practical business standpoint there are other features to be considered. The most important question is, "Can he fill the bill?" The natural answer will be, "If he was good enough to work for the company a number of years in a subordinate capacity, he certainly can." But while a certain man can perform excellent service in one capacity, he may be lost when he undertakes to work along other lines, and while it may sound brutal to say so, long service breeds in many otherwise good men a familiarity with their old associates, which is fatal to good service from them as executives. Take, for instance, the position of claim agent. It is an undisputed fact that a good claim agent is born, not made. Suppose a road has a vacancy in its claim department and that there are two applicants under consideration. One has served the road a number of years, the other has never been connected with it, but is well known for his natural aptitude on questions pertaining to the settlement of claims. Is it not the better policy for the road to appoint the latter person and get a sure thing?

True, the question has been raised time and time again that promotions from the ranks give the subordinate employees something to look forward to, an incentive to better work. But does it? We will say that there are 100 men connected with a certain division. A vacancy occurs. Of course, only one man can be promoted. He is taken from the ranks, and a large percentage of the ninety-nine who are not promoted consider that they have been unjustly treated. Then, there are executive positions that are exceedingly unpleasant. The writer knows of one such position, that of inspector in a large foundry, who works from 6 p. m. until 6 a. m., 365 days in the year. He is also in constant danger. If the position of trolley inspector was as dangerous, and if an inspector could never get a night off, would old-timers overexert themselves to secure the position?

A man accepting a position as a motorman or conductor with a street railway company is at his level. If he can secure something better, all right; if he cannot, he is not losing anything. In fact, there are many men holding high positions with street railway companies with whom it would pay the company to present them their salaries if they would let someone else do their work. The main question to be considered is, "Can he deliver the goods?"

THE BOND COMPANY, THE EMPLOYER AND THE EMPLOYEE

Professional bonding is undoubtedly of considerable good, but carried beyond a well defined limit, it acts against the interests of the railway. It stands to reason that a large street railway company should have a system complete enough in itself to conduct its own investigations, yet in many cases an applicant, who has passed the company's investigators, will be refused by the bond company for some technical reason, leaving a company short of conductors and placing it in a position in which it cannot be independent. Thus, if a delivery man for a dry goods store, who is bonded, loses a valuable parcel, perhaps worth three or four months' salary, from his wagon, and is asked to pay for it and refuses, he is blacklisted by some bond companies. The writer knew a young man that worked in a furniture store, and broke a piece of furniture, and was asked to pay for it. As it would have taken his salary for six weeks, he refused, and was compelled to resign. He made application for employment to the local street railway company and secured a position as a conductor. His former employer finding this out notified the bond company. The latter company got busy, and only through the intervention of influential friends was the man's position saved. This man is with the company to-day, and is one of its best conductors. Street railway companies should certainly not stand for the mere whims of bond companies.

VERSATILE EXPERIENCE

It seems to be a standing rule among the great majority of street railway companies not to let a man change from one department of its service to another. That is, a man that has worked as a conductor is not allowed to resign as such, and take a position as a motorman, and vice versa, except in rare cases. Such a ruling is a detriment to street railway interests in general. It stands to reason that the more versatile a man is the more valuable he is. Experience in one position helps a man to do better work in another. For instance, take motormen that have worked as conductors. Their value is practically demonstrated many times, especially during a rush trip.

Understanding as they do the requirements of the rear end of the car, they will look around if the conductor is inside the car collecting fares and will not start too soon. At a transfer point they will open the front door and call out that point. Their experience as conductors also helps them to prevent accidents.

The value of a conductor being an ex-motorman was practically demonstrated to the writer not long ago. The car on which we were traveling jumped the track. Naturally, a somewhat difficult proposition presented itself, as the wheels were nearly at right angles to the rails. The ex-motorman stood at the wheels of the car that were off and directed the motorman of the car as to the proper time to start and reverse his car. At the same time he used the jumper, and inciden-in fact in a quicker manner than if the conductor had had no experience on the front end.
perience on the front end.

And in this connection take as a supposititious case a young man in his twenties, who has secured a position with a street railway company, and is looking forward ten or fifteen years to an executive position with the company. He perceives that the more varied experience he has the better it will be for him in the future. He will probably try, after he has served in one capacity a time, to change to another. If he has influence, perhaps he will be able to accomplish this result, but in the majority of cases he will find his task an unsurmountable one with that particular road. The only course left open to him now, if he still persists in this ambition, is to resign from this road, and go to another city. While this will give him an even better practical knowledge and an insight into the workings of other managements, yet the inconsistency of the first road's management is apparent from the fact that it will later offer him a position higher up on the strength of his general knowledge.

THE DALRYMPLE REPORT

The famous report by Mr. Dalrymple, general manager of the Glasgow Corporation Tramways, on the Chicago situation, was made public by the City Council of Chicago on March 12. This is the report which Mayor Dunne has had for some nine months, but which he has refused to submit to the Council. The numerous requests by the Council to the Mayor for a copy, and its final request for another copy to the Glasgow authorities, are matters of common knowledge. The six copies of the report sent from Glasgow in answer to this request reached City Clerk Anson, of Chicago, at 10:55 a. m., on Monday, March 12. Alderman Thomas Hunter and Linn H. Young also received the opinion of the Glasgow expert. Accompanying the report was a letter addressed to the city clerk, City Council and the City of Chicago, as follows:

> The corporation have under consideration the request by your City Council that you be furnished with the views of James Dalrymple, general manager of the Glasgow Corporation Tramways, on the question of local transportation of the city of Chicago, and after corresponding with Mayor Dunne of your city on the subject, the corporation sees no good reason why they should not comply with the request of your municipality.
>
> In these circumstances Mr. Dalrymple has prepared a print in regard to the matter, and I have pleasure in sending you inclosed six copies of the same.
>
> I am, sir, your obedient servant,
>
> Alexander Walker,
> Deputy Town Clerk.

The full report follows:

MR. DALRYMPLE'S REPORT.

GLASGOW CORPORATION TRAMWAYS

46 Bath Street, Glasgow, 29th June, 1905.

The Honorable Edward F. Dunne, Mayor of Chicago.

My Dear Mayor:

As desired, I beg to send you the following notes regarding your proposal that the municipality of Chicago should now take such steps as may be necessary to own and operate its street railway systems.

In the first place, I must again convey to you the thanks of the Lord Provost and of the City Council of Glasgow for the honor you have conferred on them in looking to their city for information at this juncture.

As for myself, I have had a most delightful and instructive trip and have enjoyed myself among your people immensely. Every one I met, not only in Chicago but in all the cities I found time to visit, was exceedingly kind and all seemed anxious to give me whatever information I required. My visit to your country will, I feel sure, be of great value to me as a public official in the service of the city of Glasgow.

As I understand the position, you were elected Mayor by the citizens of Chicago on a distinct issue, viz., the immediate municipalization of the street railways of your city. Your object, I take it, in asking the City Council of Glasgow to allow me to visit your city was to learn from me how and why the municipality of Glasgow took over the operation of street railways; also that you might have full details regarding the organization and management of a municipal street railway department, and whether our experience in Glasgow could be applied to Chicago.

From the day I landed at New York I endeavored, through the press and in private interviews with yourself and your associates in the city government to tell what the municipality of Glasgow have done and are doing in this connection, and how they have made a conspicuous success in the management of all the public utilities under the control of the City Council—including, of course, the street railways, which have been operated by the city since 1894.

PUBLIC UTILITIES IN GREAT BRITAIN

It is now an accepted principle in Britain that all public utilities—such as water, gas, electric light, street railways, etc.—be under the control of the municipality. I do not know that it is necessary for me to repeat here the details regarding the management of the Glasgow street railways, as this information has been very fully given you already.

I had not been many hours in your city before I fully realized why the citizens of Chicago should be so anxious that a change be made at once in the management of your street railways, and it did not astonish me that you should have been elected Mayor by such a large majority when you had intimated to your people that, if elected, you would take immediate steps to have the street railways owned and operated by the municipality.

STUDY OF CONDITIONS

During my stay in Chicago I devoted a considerable time to the study of your street railway system. I was extremely anxious in the first place to know the history and the present financial position of the various operating and underlying street railway companies in your city, and I must confess that it took me some time to completely master the facts in connection with the various changes that have taken place in the position of these companies from time to time.

It was also necessary for me to devote some time to the study of your system of municipal government, which I found extremely interesting.

CHICAGO NEEDS A CHANGE

Regarding the present condition of the street railway system of Chicago, I consider that your citizens are fully warranted in demanding an immediate change, so that they may have the traveling facilities that are now enjoyed by the citizens of every other city of the United States.

Under the existing circumstances, the most natural, and, indeed, the only way out of the difficulty which would present itself to the ordinary citizen, who does not generally go into details, would be complete and immediate municipalization.

SYMPATHIES IN FAVOR OF MUNICIPAL OWNERSHIP

I have endeavored, in considering this important question, to look at it from every point of view—my sole object, like your own, being to recommend a course of action which would be for the common good of the citizens of Chicago. From my training and experience you can readily understand that my sympathies are entirely on the side of municipal ownership and operation of street railways, but in Chicago you are peculiarly situated in this connection at the present moment.

SEES OBSTACLES IN THE WAY

There are many questions which tend to make the position a very difficult one for a municipality to deal with. There is, for instance, the unsatisfactory state of the various franchises that have been granted to the street railway companies. If these long franchises are upheld, it would be very difficult—I would almost say it would be impossible—for your city to purchase these.

Presuming for a moment that you are able at a satisfactory figure to purchase the present undertaking, including the franchises, there would undoubtedly be a very grave danger in your attempting to operate what would be the largest street railway undertaking in the world without making a very radical change in the methods usually employed in carrying on municipal work by the cities of the United States.

And if you would seriously consider making a start on the Adams Street loop, which you may be compelled to do, this new system would undoubtedly for a long time to come add to the present confusion.

There are many other points of difficulty.

Yet, as I said at the outset, the time has now arrived when the street railways of Chicago should be put on a proper basis, and the equipment brought up to date. How should this be done?

DESIRABILITY OF SETTLEMENT

Although the time may not have yet arrived when your city could take over the responsibility, should it be the desire of your citizens to do so, yet I think an arrangement might be made now with this end in view.

I may be traveling beyond my brief in making the suggestion, but I cannot refrain from expressing my strong conviction that a serious attempt should be made on the part of the municipality and the street railway companies to arrive at a reasonable settlement.

IF COMPANIES OBJECT, START A SYSTEM

If the street railway companies do not seem inclined to be reasonable, then, I would say to you, start your municipal system without delay.

I cannot, of course, at this time go into all the details of what I would consider a reasonable settlement. The present companies must, of course, be merged into one, so that the whole may be operated as one complete system. All claims under the ninety-nine-year franchise must be waived. There must be one fare and no central loops. The use of trailer cars should be discontinued.

PRESENT EQUIPMENT, ACQUISITION

The present equipment would require in a great measure to be thrown into the scrap heap, the whole work of reconstruction being carried out at the sight and to the satisfaction of the city officers. The new operating company might be allowed a fixed time in which to have the whole system put into complete order and afterwards have a franchise for, say, 20 years, the municipality having the right, say, every 5 years, to take possession on stated terms.

A percentage of the gross annual earnings should be handed over to the city treasury to be used for specific purposes, say the upkeep of the streets; full and detailed statement of all incumbent expenditure, both on account of capital and revenue, should be produced annually by the operating company to the city officers.

The above are a few points which occur to me at the moment.

SEES GREAT TRACTION SYSTEM AHEAD

Under good, sound, economical management the street railway system of Chicago is destined not only to be the largest, but the finest in the world.

Now, presuming that the present companies are unwilling to meet you on anything like reasonable terms, what is the only course left open for you? I should say, undoubtedly, to start your municipal system on each line as the franchises expire.

AMERICAN CITIES NOT READY FOR MUNICIPAL OWNERSHIP

I should be very sorry, however, were you forced to take such a step, as, speaking generally, I should say, from my knowledge and experience of what it means to operate a municipal street railway system, that the municipalities of the United States are not yet quite ready to successfully undertake this work.

In your list of questions you ask some information regarding the management of a municipal street railway system. I would certainly recommend that the street railway department be managed by a small committee of the City Council, to be chosen irrespective of politics, and that the whole internal management be placed under one permanent officer. I have already given you very fully my views in regard to the management generally.

FAVORS OVERHEAD TROLLEY

You are anxious to have my opinion in regard to the system of traction. I say, unhesitatingly, that no other system should be thought of at the present time than the overhead trolley. If properly conducted it is not unsightly, it is not dangerous, it is the most reliable and it is the most economical, both to construct and maintain. To install the underground trolley in any extent would, for various reasons, be a scandalous waste of money.

AS TO PRODUCTION OF POWER AND FARES

In regard to the production of power, it should not be necessary for you, at the outset, to erect a power station, but when the whole system is in operation you should certainly have one central high-tension generating station, with substations. Meantime you should purchase your power.

In regard to the fares, it is unlikely that your citizens would care to change from the uniform fare with transfers, to the European system. You cannot issue transfers if you adopt the graded system of fares. The Adams street route might, however, be a very suitable one on which to test the graded system should you think it desirable to do so.

OFFERS TO AID CITY

I do not know that it is necessary for me at the present moment to say more. If you should finally decide that there is no other course open to you than to gradually municipalize your street railway system I shall let you have every assistance in my power in regard to the organization of the various departments, such as engineering, transportation and accounting, and in regard to management generally.

I have again to thank you and my many friends in Chicago for the opportunity afforded me of paying my first visit to your country and for the great kindness shown to me while I was in your city.

I am, my dear mayor, yours very sincerely,

JAMES DALRYMPLE."

SUPPLEMENTARY NOTES.

In accordance with Mayor Dunne's request for fuller information, Mr. Dalrymple sent the following "notes on the administration of the street car service by a municipality":

I.—CITY COUNCIL

The administration of the street railway department to be entirely under the control of the City Council. They should appoint annually from their number a transportation committee and should also appoint the general manager. All minutes of the transportation committee should be regularly submitted to the City Council for approval.

II.—TRANSPORTATION COMMITTEE

As stated above, the City Council should appoint annually from their number a transportation committee consisting of, say, from twelve to fifteen members. This committee should carry out the work of the street railway department like the board of directors of the private corporation. The regular meeting of this committee might be held, say, every fortnight, for the transaction of all business in connection with the car service. This committee might, with advantage, appoint the following sub-committees:

1. Sub-committee on finance.
2. Sub-committee on extension.
3. Sub-committee on stores.
4. Sub-committee on staff.

All matters referred to these sub-committees to be approved by the parent committee.

DIVISION OF WORK

Sub-committee on Finance—The sub-committee on finance would carry through all financial transactions, pass all accounts for payment, and receive reports from the general manager regarding the revenue and expenditure of the undertaking. They would also prepare reports and issue an annual financial statement. This sub-committee would also effect all insurances. It would also see that all revenue was duly accounted for and lodged in bank. All borrowing on capital account would also come under this committee, which would see that all payments for interest and sinking fund were properly applied. It might be well also to remit to this committee any proposed alteration of fare and the collection of same.

WORK OF EXTENSION COMMITTEE

Sub-committee on Extension—All proposals regarding extensions of the system should be remitted to this committee for consideration and report. Any negotiations which might be rendered necessary on account of any extension of the systems might be carried through by this sub-committee. This sub-committee might also take in charge the obtaining of the necessary powers for making extension of the system and also any suggestion regarding the fixing or alterations of routes.

WORK OF COMMITTEE ON STORES

Sub-committee on Stores—This sub-committee should take charge of the drawing out of specifications and schedules for the carrying out of any work for the department, and also for the purchase of material and supplies. This sub-committee would see that all requirements were duly advertised in accordance with the standing orders of the City Council. They would meet regularly to open all offers and to consider same. Their recommendation of acceptance of offers would, of course, be submitted to the parent committee for approval.

SUB-COMMITTEE ON STAFF

Sub-committee on Staff—The sub-committee could consider all salaries and wages, hours of labor and general condition of service. All applications by members of the staff for increase of wages, etc., could be remitted to this sub-committee for consideration and report.

GENERAL MANAGER

It would be a mistake for you to take a single step in the organization of the street railway department until you had first of all secured the services of a general manager, who would be the adviser of the transportation committee and the City Council from the very start.

SELECTING THE GENERAL MANAGER

As indicated in my letter to you, the general manager should be appointed by and be directly responsible to the City Council throught the transportation committee. He should be a man who has had experience in dealing with large bodies of workmen and a good organizer. If possible, you should secure a man who has had experience in the operation of a large street railway undertaking. He should have absolutely no connection with any political party and his appointment should be made solely on account of his fitness for the position. The success or failure of the undertaking depends in a very large measure on the manner in which the general manager carries out his duty. You will, no doubt, see that it would be impossible to secure the best man for the position unless he has an agreement over a period of years and is made entirely independent of all changes in the City Council. The City Council should give the general manager complete control of the whole staff. He should be held personally responsible for the good conduct of those under him. He should be absolutely free to engage and discharge his men.

GENERAL STAFF

Under the general manager, and directly responsible to him, there should be three heads of departments—first, the chief engineer; second, the traffic superintendent, and, third, the financial superintendent. The chief engineer will require the assistance of an electrical engineer, who shall be directly responsible for all the electrical plant; a mechanical engineer, who shall be directly responsible for the workshops; a civil engineer, who will be charged with the upkeep of the permanent way; and a draftsman.

TO HAVE CHARGE OF CAR SERVICE

The traffic superintendent shall have charge of the car service and all the car-service employees, such as inspectors, timekeepers, motormen, conductors, etc. He will be responsible for the conduct of all under his charge. He should personally engage all the traffic staff and should also be responsible for the disciplining of his men. The time tables of the cars and the laying out of more routes will also come under his charge. He will receive all reports from the inspectors on the road and also from motormen and conductors, etc., and will take general charge over all matters relating to operation of cars.

TO LOOK AFTER FINANCES

The financial superintendent shall have under him an accountant, with a bookkeeping staff, cashier, pay clerks, purchasing clerks, corresponding clerks, etc. He will be responsible for the conduct of the general office, and the preparation and checking of all financial statements required by the general manager.

SELECTION AND TRAINING OF STAFF

In the organization of a municipal railway department a very great deal depends on the arrangements that are made for the selection and training of conductors and motormen and also on the standard of efficiency that is set up and maintained. From the separate print which I send you you will get full details as to our methods of selection and training in Glasgow. The system we have adopted is working admirably. It will very likely be necessary for you at the outset to begin operations with men who have had experience in street railway work, but very soon your general manager will find it to be to your advantage to engage young men and train them himself.

TRAINING ORIGINAL MEN

We in Glasgow rarely engage a man who has been in street railway work before, and we have made it a rule never to reengage a man who has been in our service. A strict medical examination you will find to be absolutely necessary, and, as you will find no difficulty in obtaining application from suitable young men, you will be able to fix the standard very high. We engage all our men on the understanding that, after serving for a few months conducting a car they must, when asked, go through the motor school and learn to drive a car. If a man fails to qualify as a motorman, he has to leave the service.

WORKING HOURS

The working hours of the traffic staff in Glasgow are, on an average, nine hours a day. The staff work any six days out of the seven. When we started operations we allowed the men to work seven days if they chose, but now we have a strict rule in force that no man is to be allowed to work more than six days a week. We find this is a very good rule, and it is strictly adhered to. Our time tables for the operation of the cars are very carefully drawn out, so that nearly all our men finish their day's work within 12 hours; that is to say, from the time reporting in the morning till the time that a man is relieved at night should not exceed twelve hours. In a few instances the spread-over reaches fourteen, or in one or two cases fifteen hours; but these come in the cycle of duties very rarely and cannot be avoided.

DURATION OF EACH SHIFT

We endeavor to give a man 4½ hours on duty for each shift, so that every man is relieved about the middle of his 9 hours' work. Of course, the work-shop staff and all artisans employed in the department work whatever hours are fixed for, the time being fixed by the different trades. The corporation always pays what is recognized as the trade union rate of wages, and where no union rate exists we pay whatever is recognized as a fair rate in the district.

FARE COLLECTION

The American system of fare collection is, of course, entirely different from that in general use in this country. Our system of graded fares necessitates a much more complicated system of check than is necessary where there is one uniform fare. It is generally admitted, however, by your street railway men that your system of check is very deficient. With our system of check I believe we get the money that is collected by the conductors, whereas with your system it is generally recognized that the street railway corporation does not get all the money from the conductors that they collect from passengers. Our routes, as you know, are divided into stages of rather over half a mile each on the average. For each one of these stages a passenger pays 1 cent. If he desires to travel farther he can travel over any four consecutive ½-penny stages for 2 cents, and six stages for 3 cents, any eight stages for 4 cents, etc.

COLLECTING FARES IN GLASGOW

Whenever a passenger pays his fare the conductor punches a ticket in the section over which the passenger is entitled to travel. The passenger is bound, so long as he is on the car, to retain this ticket and exhibit it to the conductor or inspector when asked to do so. The conductor's bell punch registers the number of passengers he has carried. The conductor is, in addition, responsible for every ticket which he receives and the inspectors on the route board the cars frequently in order to ascertain that every passenger is in possession of a ticket and is traveling on the section for which he has paid. We endeavor to make this check—both on the conductor and passenger—as complete and perfect as possible, and in Glasgow we find no difficulty in getting the people to co-operate with the department in this connection.

NO TRANSFERS IN GLASGOW

In Glasgow we have no transfers—indeed, with our system of tickets and the division of our routes into stages, transfers are really not necessary, and, in fact, it would be very difficult to carry out a transfer system. In introducing a municipal car service in Chicago, you cannot be too careful in obtaining full powers to deal with passengers in connection with any offenses against your rules and regulations. Our judges here uphold the department in enforcing our rule.

PUNISHING OBSTREPEROUS PASSENGERS

Only the other day a passenger, when asked by the inspector to show his ticket, pointed to the floor of the car and said his ticket was there and that he (the inspector) could pick it up and look at it if he pleased. The inspector refused and asked the passenger to pay again. This he would not do. He was summoned to appear at the police court and was fined $1.25 for not paying his fare. It would be very unfortunate for a municipality working a street railway to have any looseness in the fare collection, as any slackness might lead to abuses which would result in very heavy losses. It is worth a very great deal of trouble to be able to keep the staff honest. Your people in Chicago might consider that any system such as I have described might be a step backward. We, however, knowing what the results might be, would not think for a moment of relaxing our checks in the slightest degree.

CONCERNING A POWER STATION

There are only a few municipalities having a separate power station for the street railways; the usual plan is to have a combined lighting and traction station, the station being under the charge of the city electrical engineer, the street railway department simply requiring to pay a price per unit for the power used. In Glasgow, however, and in several of the other large cities the street railway department has its own power station. For our system, which is designed for about 250 miles of single track and 900 cars, we have a power station with a total capacity of 11,000 kw, with a staff of 100 men. We have high-tension current at 6500 volts, converted at five sub-stations to 500 volts direct current. The power station is under the charge of a superintendent, who is responsible to the chief engineer. You will find our power costs fully detailed in the annual report for 1905, copy of which has already been sent you.

MAINTENANCE OF TRACK

It will be necessary for you to organize what we call a permanent way staff for the maintenance of your track. Under a municipal street-car system the track is very often under the city engineer and the annual cost of the maintenance is charged to the street railway department. In the larger cities, however, it is usual for the permanent way staff to be under the charge of the street railway department. In Glasgow, in addition to maintaining the track, we frequently lay extensions of the track by our own staff. As a rule, however, we do all extension work by contract. In order to keep the track in perfect order a very large staff is required. We have at present rather over 150 miles of single track and we have altogether in our permanent way department about 650 men. These men are divided into squads of various sizes, each squad being responsible for the maintenance of the lines in a certain district. Each squad is under the charge of a separate foreman, the whole being under a civil engineer, who is responsible to the chief engineer.

OVERHEAD EQUIPMENT

Another department of the service is the staff charged with the erection and maintenance of the overhead equipment. This staff is divided into three sections:

1. The staff charged with the construction of the overhead equipment for new lines. We do all this work by our own staff.
2. The maintenance staff, which is continually on the road inspecting the wires.
3. The emergency staff, which is at call should any part of the overhead equipment give way.

Each of these squads is under a foreman, who is responsible to the chief engineer.

FEEDERS AND CABLES

The upkeep of the mains and cables, as well as the electrical equipment at the power stations and sub-stations, is under the control of the electrical engineer. The mains and cables staff not only look after any faults in the cables, but they lay all new work, as we prefer to do this work by our own staff.

ARRANGEMENT OF CAR HOUSES

We find that the most suitable size of a car house is to have accommodation for from 150 to 200 cars. In designing your car houses you should make near the entrance gate a commodious office for the accommodation of the motormen and conductors and the traffic staff generally. In a car house holding, say, 200 cars, it is necessary to have an office measuring about 720 sq. ft. There should also be a store for the material used by the repair staff, a fitters' workshop, and a room for the cleaners, where the men can store their cleaning material, brushes, etc. Ample kitchen, lavatory accommodation and bath should also be provided. We have also in our car houses a large reception room, fitted up with gymnastic appliances, tables, chairs, drafts, chests, bagatelle, etc. At all our car houses there are car pits almost over the whole car house for convenience in inspecting and repairing trucks and motors. Our most recently constructed car house has accommodations for 180 cars, and covers 14,747 sq. yds. The cost of the land was $25,000, and the cost of the building was $127,000.

MAKE-UP OF CAR-HOUSE STAFF

The staff at the car house is made up as under:

TRAFFIC STAFF	
Motormen and conductors	335
Depot clerks	3
Pit cleaners	3
Total	341
REPAIR STAFF	
Foreman fitter	1
Fitters	4
Truckmen	4
Controllermen	3
Handy man	1
Total	13
CLEANING AND OILING	
Car cleaners	48
Greasers	3
Sandman	1
Total	52

HIS IDEAS AS TO REPAIR SHOPS

It is advisable to have one general workshop for the maintenance of the rolling stock and all plant connected with the street-car service. We in Glasgow have a workshop covering an area of over 25,000 sq. yds. We started at first on a much smaller scale, but as we had secured the ground we were enabled from time to time to extend our premises, which now cover all the ground originally purchased. In this workshop we not only do repair work, but we have built all the 700 cars belonging to the department. In addition to the general store, which is adjacent to the workshop, we have a saw-mill, car-building shop, repair shop, paint shop, blacksmith shop and fitters' shop. All these departments are equipped with the most modern machine tools. Each department is under the charge of a foreman, the whole workshop being under a general works manager, who is responsible to the chief engineer for the conduct of his department. The staff employed at present numbers over 500.

GENERAL STOREROOM

You will find it of very great service to equip a large general store, where all material and supplies should be delivered for distribution throughout your system. The general store should, if possible, be adjacent to your workshops, and should be under the charge of a competent store man. I have already given you a copy of our standard list of stores; since we issued this list we have found that the dealing with stores has been very much simplified; each foreman who is requisitioning for stores has a copy of this list and he has simply to quote the standard list number and there is no dubiety as to the material he wishes. These particulars are all fixed to the different partitions, both in the general store and also in the subsidiary stores, and each of the car houses. I have already supplied you with a copy of each of the forms which we use in connection with the requisitioning and dispatching of material from the general store.

RULES AND REGULATIONS

In the book of rules and regulations for the staff which I left with you you will find what we call our by-laws, giving the different offenses which are punishable by fine or imprisonment. By the act authorizing the municipality to operate the street railways, we are empowered to make these by-laws. It might be worth your while to take a look through our by-laws, to compare the powers which we possess with those of the street railway companies of Chicago.

ACCIDENT CLAIMS

This part of the work of a street railway department is becoming a very important one, as it costs a very large sum annually to settle accident claims. In the United States I found that the street railway companies were even worse than they are here. Our practice in Glasgow has been to insure against accident claims. The private corporation which has taken this work in hand has room in the office of the department and all reports and claims are immediately handed over to the insurance officials, who investigate all accidents and settle or contest all claims. Last year we paid a premium amounting to about $75,000. This covered us for claims in connection with any single accident amounting to $12,500 and an annual total of $125,000.

We consider that it is much better for a municipality to give this work into the hands of a private corporation than for the claims to be settled by the transportation committee and possibly discussed by the City Council.

The work should only be undertaken by the street railway department, with the general manager given full power, so that accident claims would not fail to be discussed by the transportation committee and the City Council.

ANNUAL FINANCIAL STATEMENTS

In Glasgow we have from the very first issued a full annual report and financial statement. I have already handed you a set of these reports from 1894, when we began to operate the street railways, and have since my return sent you a copy of the report for the year which has just closed. The form of our income and expenditure statement and also of our capital account is almost exactly the same as that which has been adopted by the street railway corporations of America. I think in issuing your annual statement you could not do better than have it prepared on the American form—which, as I said, is practically the same as our own. It is necessary, of course, to make a slight difference in the allocation of the net revenue, but this does not in any way affect the question. You, of course, are issuing the accounts of a municipality, which are necessarily slightly different from a private corporation.

BENEVOLENT ASSOCIATION

I think you would find it very advantageous to inaugurate a friendly society among the men belonging to the street railway department. In Glasgow, we have had a very flourishing Friendly Society for a number of years. Membership is quite optional. Out of a total staff of 4400, we have 3370 members. The non-members are chiefly artisans, who have their own trade societies, and the lower class of laborers. Practically all the traffic staff are members. We consider that this society has been a great assistance to the department and to the staff in many ways. It induces the men to remain with the department and take an interest in their work. I have already given you copies of our Friendly Society reports, and also of our rules and regulations, and I think a set of forms.

ADVISES CHICAGO TO HAVE ASSOCIATION

Nearly all the municipal railways in this country are now forming friendly societies, and I think it would be well for you to go fully into the question. You will see from the rules that in Glasgow each member pays 12 cents per week to the funds of the society and the department adds 6 cents. When a member is off for sickness on a doctor's certificate he receives 15 shillings, or about $3.60 a week for the first 6 months; 10 shillings, or about $2.40, for the second 6 months, and 5 shillings, or about $1.20, for the second year. He also receives medical attendance and medicines free of charge. Admission lines to infirmaries and convalescent homes are also available for members and their families.

SUPERANNUATION FUND

It would be advisable also to institute a superannuation fund, which can be accummulated so that it will be possible to grant a small weekly allowance to members of the staff who, after long service, may have become unfit for work. We have instituted such a fund in Glasgow and we are accumulating it as speedily as possible. To this fund 2 cents per week per member is contributed by the members of the society. These 2 cents are taken from the 12 cents contributed to the Friendly Society and the department adds another 2 cents. This fund does not come into operation until 1911. A municipality cannot throw off its old and infirm servants as a private corporation can do. And therefore it is well to make provision for them.

TEXT OF OTHER CORRESPONDENCE.

With the Dalrymple report was made public the full text of the correspondence between Mr. Dalrymple and Mayor Dunne and the officials of Chicago and Glasgow. This correspondence opened on July 10, 1905, with a cablegram from Mayor Dunne to Mr. Dalrymple, saying:

"Can you give me a fuller report? Answer. Have written."

Next day came this response from Mr. Dalrymple by cable:

"Cable received. Will send complete report. Write me full information required in view my letter."

Mayor Dunne replied by letter under date of July 15, saying:

"Following my cablegram on the subject of your recent communication I wish to say while I greatly appreciate what you were good enough to submit I would like very much if you should write me at length advising on the subject of administration of car lines by the municipality. Your great experience in administration in Glasgow qualifies you to lend advice on that subject, which presents to us the remaining unsolved problem. While you touched on this subject in your communication, I should be pleased if you should write me now as fully and with as much detail as you will on that subject."

LETTER FROM TOWN CLERK

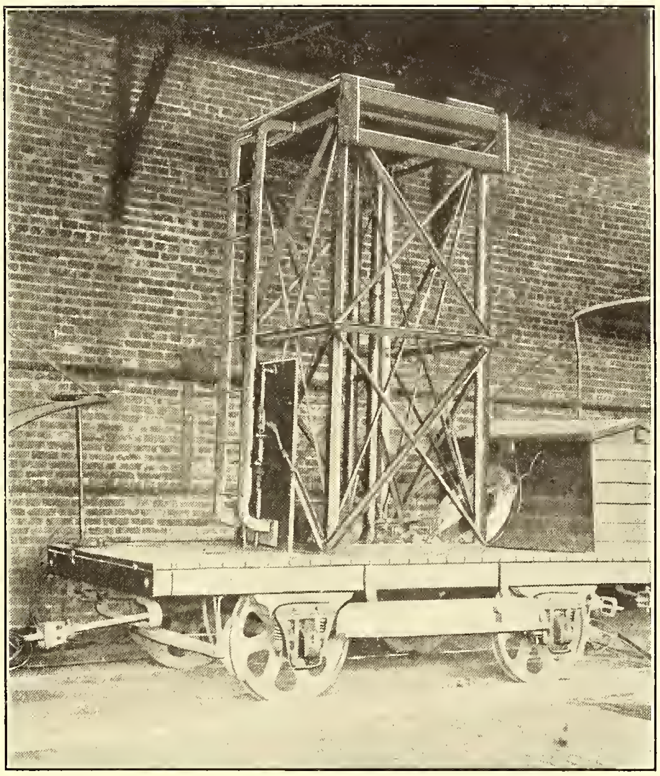
Mr. Dalrymple acceded to this request. After his supplementary letter to Mayor Dunne there followed a letter from A. C. Miles, the town clerk of Glasgow, who told the Mayor it was not understood in Glasgow that Mr. Dalrymple was the guest of Mayor Dunne personally, but of the municipality. The correspondence on this subject has already been published in this paper.

There is also included in the correspondence a report to the Glasgow tramway committee by Mr. Dalrymple on Feb. 19, 1906. In this report Mr. Dalrymple asserts he has given Mayor Dunne what he considers the best plan looking to municipal ownership.

A HYDRAULIC TOWER CAR

A tower car of unusual design operated by hydraulic pressure is in service on the lines of the Atchison Railway, Light & Power Company, Atchison, Kansas. The car, which is shown in the accompanying photograph, was constructed in the company's shops.

The frame mounted on a small push car is similar in many respects to the usual design. Extending upwards from the



HYDRAULIC TOWER CAR IN USE AT ATCHISON, KAN.

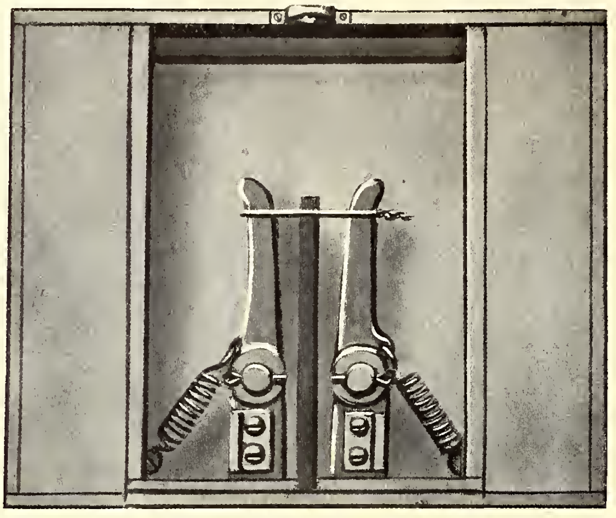
floor inside the frame are two $3\frac{1}{2}$ in. wrought iron pipes placed about 15 ins. apart and lined with $2\frac{1}{2}$ in. pipes of brass. Leather packed pistons working in these pipes raise the platform.

A seven-gallon tank placed on the floor inside the frame is filled with a mixture of two gallons of alcohol to five gallons of water. Operating a force pump mounted on a board under the ladder forces the fluid out of the tank under the pistons, and raises the platform. Master Mechanic D. S. Beatty states that the platform is raised to its full height, 8 ft., in one minute by one man at the pump. This is accomplished with two men on the platform.

With a view of introducing electricity along the line of the Kokomo, Marion & Western Traction Company for domestic uses, President Marott, of the company, has secured Mrs. A. V. Sanborn, of St. Louis, to deliver lectures on cooking by electricity and demonstrate to the farmers' and villagers' wives how successfully and economically electricity can be used in the home. The company managers believe when people living along the line acquire a knowledge of the comfort, convenience and economy of electricity, a considerable demand will be created for current.

A QUICK-BREAK FUSE BOX

The accompanying illustration shows a combination fuse and circuit breaker which the American General Engineering Company, of New York, has brought out for use with or without any circuit breaker. It is positive in action owing to its being constructed as a tension fuse and can be set at



QUICK-BREAK FUSE BOX, WITH COVER REMOVED

any amperage required. It is a certain safety check on the circuit breaker and is generally set at about 20 amp. above the latter. This device can also be used in place of the circuit breaker or fuse because it is a combination of both. Accidents caused from defective circuit breakers and other style of fuses are absolutely eliminated. This box has been tested by some of the largest railroad companies by dead short circuits on third rail and overload on trolley lines, and the results from a short circuit of 3000 amps. are said to be scarcely more perceptible than from an overload of 200 amps. The installation of this box is practically the only cost, as fuses for any amperage can be furnished for one cent each. A large number of these boxes have been installed on several important railway systems in the East.

The box contains two brass arms which are pivotally connected to two brass terminals attached as shown in the cut. The fuse wire is fastened across the ends of the brass arms and is held in place by the tension obtained from 1-16 in. steel springs connected to the arms. The arms are separated by a strip of fiber. When the box is operating the legs of the circuit are connected to the brass terminals and the fuse wire put in place. Should there be a short circuit or any other trouble causing the current flow to increase over the working capacity, the fuse wire softens and is instantly broken by the tension of the springs fastened to the arms. The arms fly back against the rests that are provided in the box. To prevent all possibility of fire the box is lined with asbestos and has two compartments. One of these sections is provided for the terminals, arms, etc., while the other acts as a condenser, that is, in the breaking of the arc when the fuse melts, the arc rushes through the hole in the wall directly in front of it and into the smaller compartment, so that a vacuum is formed therein, and the arc instantly extinguished.

The principal features of this fuse box are its ability to break a circuit quickly without drawing an arc for any appreciable length of time, its positive action and its quiet operation as compared with the noise and shooting flames associated with many other fuses. There must be something radically wrong before the circuit is broken, and a small overload will not affect it. The fiber that is placed between the arms and terminals prevents any opportunity of arcing across at any other place than the fuse wire, while the condenser positively extinguishes the arc. This fuse box might be termed a combination circuit breaker and fuse, as it really performs the duties of both.

FIRST GASOLINE-ELECTRIC CAR FOR THE VANDERBILT LINES

The G. C. Kuhlman Car Company has recently completed the handsome interurban type of car shown in the illustration for the Lake Shore & Michigan Southern division of the New York Central lines. This car is being equipped with the Chase gasoline motor system, which Frank L. Chase, president of the Jamestown, Chautauqua & Lake Erie Company and Chautauqua Steamboat Company, has been developing for several years. This is the first car for gasoline operation to be experimented with on the Vanderbilt lines, and railway men in general are looking forward with much interest to the trial trips which will shortly be made on a line between Cleveland and Willoughby.

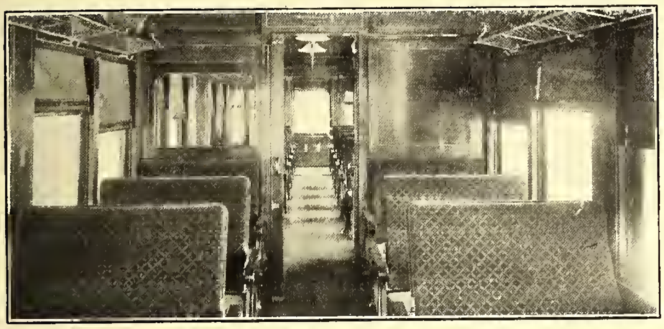
The car is operated by a gasoline engine in connection with an electric generator, the engine being 220 hp. All of the operating and propelling machinery is located beneath the car. The car is operated from either end, similarly to the ordinary type of electric car, and is handled in much the same manner. It is electrically lighted, heated by hot water and equipped with M. C. B. standards throughout, with high-speed brakes and designed for a speed of 65 miles per hour. The car is considered to be a particularly fine piece of workmanship, although the time allowed for building was very limited. Unfortunately, it had to be photographed on a stormy day, and therefore the picture of the exterior gives a very inadequate idea of the appearance.

GASOLINE-ELECTRIC CAR, BUILT FOR OPERATION ON THE LAKE SHORE & MICHIGAN SOUTHERN RAILWAY

The interior is richly, though plainly, finished in mahogany, with inlaid lines of white holly. The dome is of the Empire style, tinted light green and decorated in gold. A hardwood partition divides the smoking compartment from the rest of the car, and against the partition at one side is a toilet room of standard steam-car character. Seats 37 ins.

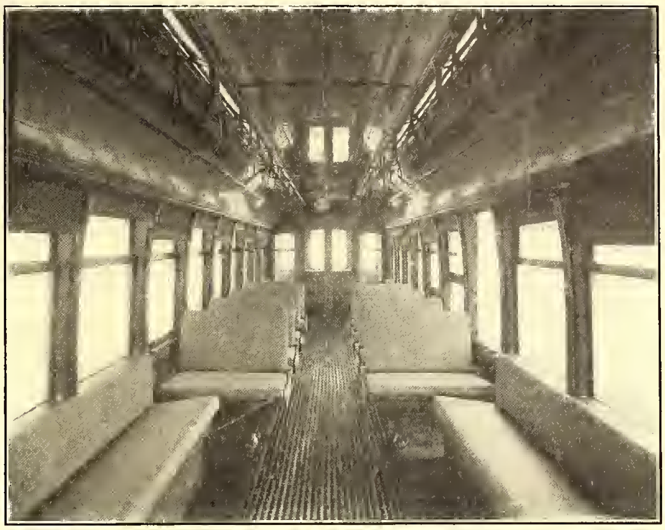
wide, of the Lake Shore standard design, are upholstered in plush and have push-over backs and mahogany arm-rests at the aisle ends. The passenger compartment seats twenty-six passengers and the smoking compartment sixteen. The windows are arched in pairs, and leaded art glass is used in the upper part. The lower sashes are arranged to be raised in the usual manner of steam-car construction.

The platforms are flush the car floor and enclosed in round-end vestibules with folding doors at the entrances. The length of the body measures over the end panels 34 ft. 4 ins., and over the vestibules, 43 ft. 9 ins.; width over side sills, including sheathing, 9 ft.; height from the track to the under side of the sills, 3 ft. 6 ins., and from the under side of the sills over the roof, 9 ft. 10 ins.; from the floor to the ceiling is 8 ft. 11 ins. The bottom framing is powerfully constructed, and includes 5-in. x 8-in. yellow pine side sills, 6-in. I-beam center sills, 7-in. x ⅝-in. sill plates, and oak end sills, 6 ins. x 8 ins. The king posts are placed under needle beams composed of I-bars. At each end are steel pilots which are brought up close under the angle-iron bumpers, and M. C. B. couplers are fitted through them.



INTERIOR OF LAKE SHORE CAR

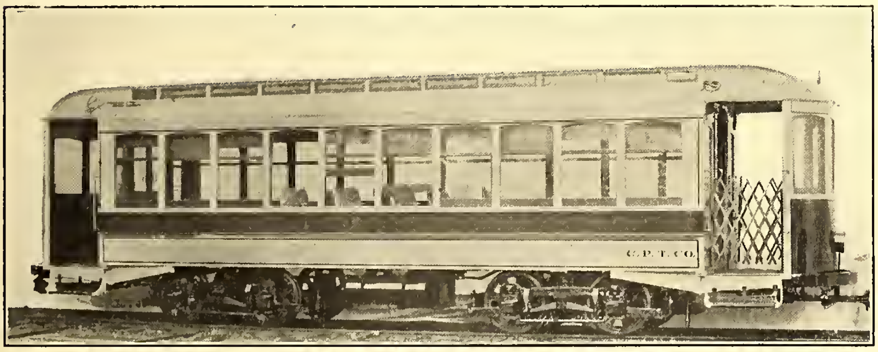
Cars of the same type are used on the Valley Traction Company's lines between Mechanicsburg and Harrisburg, and also on a railway east from Hummelstown. The type is much in favor in this section of the country, and it is said that no less than forty-eight different companies in Pennsylvania are operating with it.



INTERIOR OF HARRISBURG CAR, SHOWING LONGITUDINAL SEATS AT THE ENDS

SEMI-CONVERTIBLE CARS FOR HARRISBURG

The Central Pennsylvania Traction Company operates several large systems running out to the east and south of Harrisburg and including the systems of the city of Harrisburg. Harrisburg, besides being the capital of Pennsylvania, is important on account of the large industrial plants, including several of the most extensive steel works in the country. It has a population of over 50,000 and there is also a large population in the numerous manufacturing towns in the immediate vicinity. Five cars of the grooveless post semi-convertible type have recently been received from the J. G. Brill Company and placed on the division of the company's lines running between Harrisburg and Hummelstown.



DOUBLE-TRUCK VESTIBULED CAR FOR THE CENTRAL PENNSYLVANIA TRACTION COMPANY

The seating plan of the new cars is unusual, as will be seen by the illustration of the interior. Longitudinal seats at the four corners each extend the length of three windows, leaving only four windows at the center of the car for transverse seats. The arrangement increases the capacity of the car by providing extra standing room and also makes it easier for passengers moving in and out when the car is crowded. This is an important feature, because the stops are frequent and passengers riding a short distance can occupy the longitudinal seats, while those who ride for a considerable distance have the more comfortable seats at the center of the car. The transverse seats are 36 ins. long, are upholstered in spring cane and have pushover backs with corner grabhandles. Both the side and cross seats are of Brill manufacture. Some of the window sashes in the picture are shown entirely raised into roof pockets, while others are partially lowered, and one can imagine the open appearance of the car when all the sashes are raised into the roof pockets. The low window sills and the large window openings give it much the appearance from the interior in summer of an entirely open car.

The cars are of standard dimensions and have the standard bottom framing of this type. The length over the body is 28 ft., and over the vestibules, 37 ft. 5 ins.; width over the side panels, 7 ft. 10½ ins., and over the posts, 8 ft. 2 ins.; distance from the center to the center of the side posts, 2 ft. 8 ins. The platforms have stationary round-end vestibules with window sashes which are arranged to drop into pockets. The entrances are without doors, but have folding gates manufactured at the Brill Company's works.

Other specialties of the same make with which the cars are equipped are channel-iron radial draw bars, angle-iron bumpers, brake handles, platform gongs and signal bells, and the cars are mounted on two No. 27-G short-base equalized double trucks.

HAND-POWER EYE AND ANGLE BENDERS

Small hand-power tools can often be used to advantage both in small shops, where a limited amount of light work is done, and in shops of larger capacity well equipped with up-to-date machinery. The usefulness of such tools is unlimited and much time may be saved by their proper application. Hand-power machines with a wide field of usefulness, have recently been designed by the Wallace Supply Company, of Chicago, for bending square and round rods or flat stock, and for forming hooks and eyes on the ends of rods. The

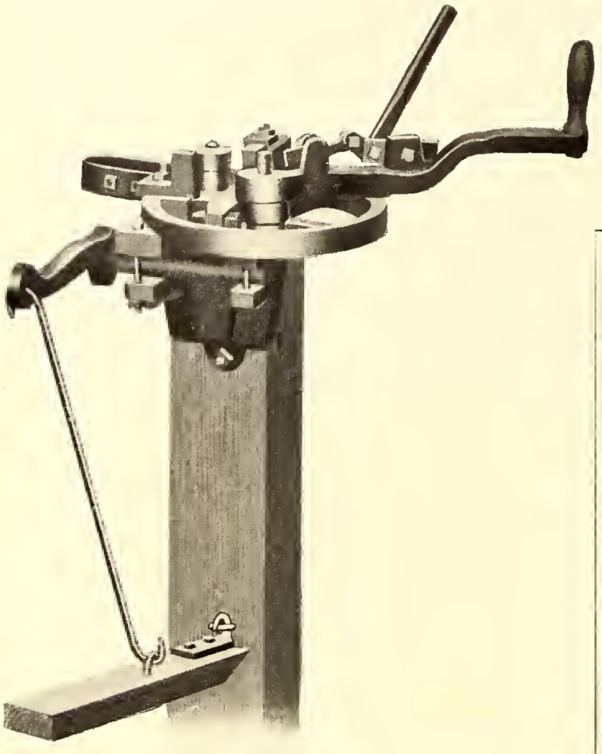


FIG. 1.—SMALL HAND-POWER EYE BENDER

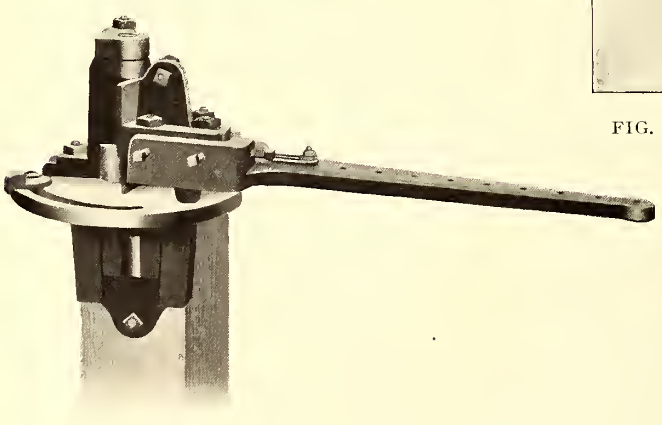


FIG. 2.—HAND-POWER ANGLE BENDER

hand eye benders are made in three sizes. The smallest size (No. 1 shown in Fig 1) takes stock up to and including one-half inch in diameter, and bends rings and eyes up to 2¾ ins. outside diameter. The next size (No. 2) takes stock up to and including three-quarters inch in diameter, and bends rings and eyes up to 3 ins. outside diameter, and the largest size (No. 3) takes stock up to and including 1⅜ ins., and bends rings and eyes to 7 ins. outside diameter.

Referring to Fig. 1, the principle on which this machine works may be clearly seen. Operating upon and attached to the large handle, is a small dog moved by a light lever. This dog presses the material to be bent against the pin shown in the center, so that when the large handle is turned the stock is pulled around the pin. A second dog, adjustable and held in position by bolts, guides the stock so that it may be bent to the desired form. The final adjustment of the second dog is made by the foot-power lever shown, making the final bend of the form. The pin in the center extends through the table, and is held rigidly in position by a nut at the lower end. The pin may be turned to any size to suit the demands of the user. In using the machine, it is not necessary to swing the full length of the bar, therefore a long rod may be handled conveniently.

The machine is supported by a cast-iron lug which fits into a socket, and may therefore be easily removed and put out of the way when not in use. The socket is bolted to the side of a bench, to the wall, or anywhere that may be desired.

The hand angle benders are made in three sizes. The smallest machine (No. 1) has a capacity for bending iron or steel up to and including 2-in. wide by ⅜-in. thick, or

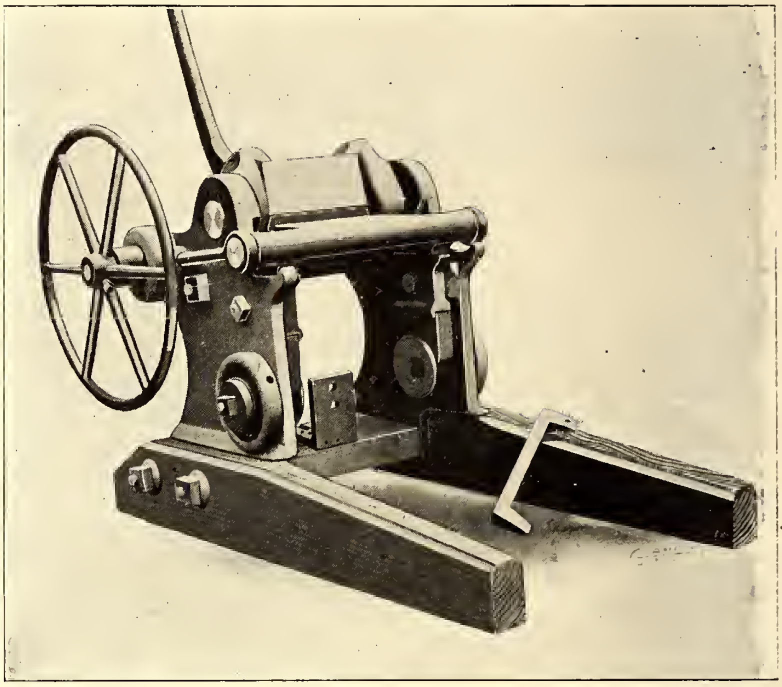


FIG. 3.—LARGE ANGLE-BENDER MACHINE, OPERATED THROUGH HAND WHEEL

¾-in. round or square stock, and will form any angle from zero to 90 deg. Angles less than 90 degs. may be made by the use of a special, sharp-angle die. The next size (No. 2) takes flat stock up to and including 4 ins. by ½-in thick, round and square stock up to and including 1 in., and will form any angle from zero to 90 degs.

The operating principle of this machine is clearly shown in Fig. 2. The adjustment is quickly and easily effected. To set the machine for bending a right angle, the movable die is placed back the thickness of the stock both ways from the other two dies. For angles less than 90 degs., the front die is set ahead or toward the center pin far enough to allow the corner to hug tight against the stationary die at the corner of the bend. The small tongue on the handle serves as a gage and may be set at any point. The small stop block may be moved back and forth in the semi-circular slot to suit the degree of the angle that is to be formed.

The largest size, or No. 3, has a capacity for bending stock up to and including 1½-ins. by 12-ins. wide, and is regularly fitted with a die for bending up to a right angle, but when required a die is furnished that will bend to any angle up to 45 degs. As shown in Fig. 3, the stock is put in and clamped fast by operating a hand-wheel which is on the side, and then by pulling down the lever the piece is bent over to the shape desired. The machine is operated

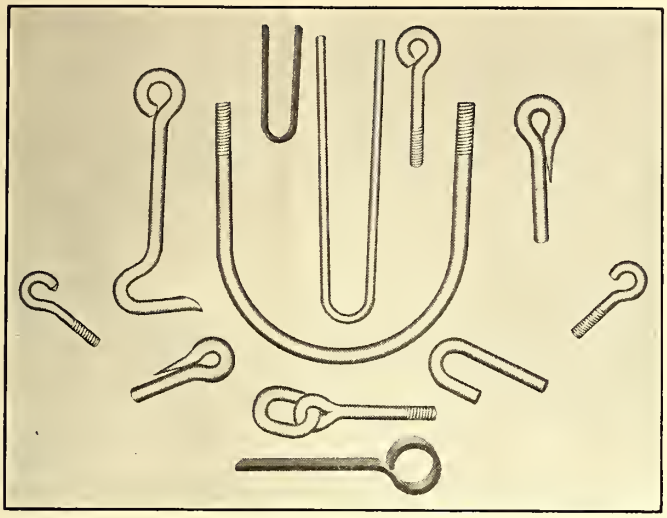
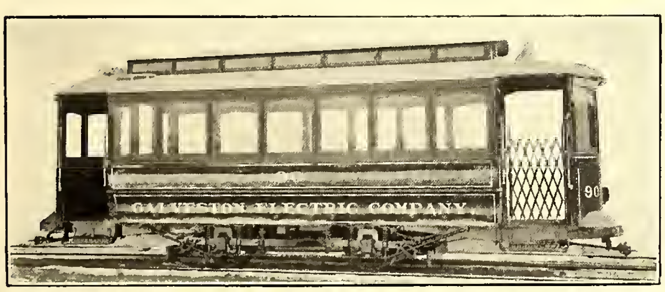


FIG. 4.—SOME SAMPLES OF WORK DONE WITH HAND-POWER EYE AND ANGLE BENDER

by one man, except in the case of very heavy work, when two men are required. Specimens of the work done with these machines are shown in Fig. 4.

NEW EQUIPMENT FOR THE GALVESTON ELECTRIC COMPANY

The Galveston Electric Company, of which Stone & Webster, of Boston, are the managers, has lately received a shipment of closed cars from the American Car Company, of St. Louis. The Galveston lines have a trackage of 35 miles and require about seventy motor cars, equally divided between open and closed types. Galveston has a population of about 40,000, and is one of the busiest cities in the country for its size. It has an immense foreign and interior trade and is especially notable for its cotton exports. The level land on which the city is laid out and the width of the streets enable the cars to keep up a fairly fast schedule at an economical



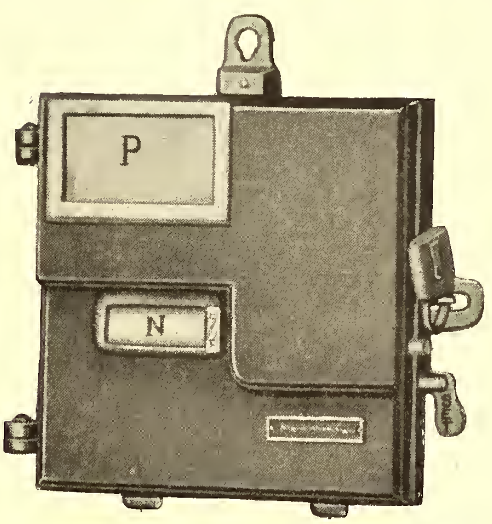
SINGLE-TRUCK CAR FOR THE GALVESTON ELECTRIC CO.

consumption of power. The climate is excellent for most of the year, with a short rainy period in the winter season.

The type of car shown has been in standard use on the Galveston lines for a number of years. The length of the body is 20 ft., and over the vestibules, 29 ft. 5 ins.; width over the sills and the panels, 6 ft. 3 ins., and over the posts at the belt, 7 ft. 6 ins.; sweep of the posts, 8 ft.; distance between the centers of the posts, 2 ft. 9½ ins; height from the floor to the ceiling, 8 ft. 3¾ ins.; height from the rails to the sills, 2 ft. 2⅝ ins.; from the sills over the trolley board, 9 ft. 3⅝ ins. The platform steps are 14⅝ ins. from the rails, and from the step to the platform, 12 ins. The interiors are finished in cherry with ceilings of decorated birch. Longitudinal seats of spring cane are used and the sashes drop into side walls in the usual manner. The trucks are the No. 21-E type with 7-ft. 6-in. wheel base, 33-in. wheel diameter and 3¾-in. diameter of axles. Two motors are used per car of 25-hp each. The vestibules are stationary, with folding gates at the entrances. Sheet steel coverings are provided over the bumpers, inclined to prevent persons from gaining a foothold.

AN AUTOMATIC SECRET FARE REGISTER

The Traction Equipment Company, of New York, has recently taken up the manufacture of the Keystone fare register, a secret recording device which makes it impossible for the conductor to tell how many fares have been registered. Hence, to avoid "overs" and "shorts," it is necessary for him to turn in all of the money in his possession minus the amount with which he started. The appearance of the standard type of this machine is shown in

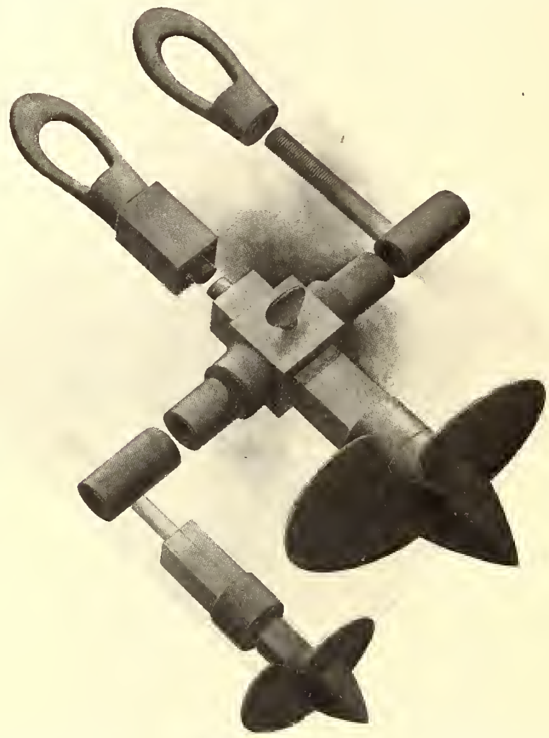


AUTOMATIC SECRET FARE REGISTER

the accompanying cut. Cords or rods for ringing up the fares are attached to each side of the register, so when the conductor records a fare he causes a gong to ring and a picture to appear in the space lettered "P." As the same car may be in charge of several conductors before the auditing department examines the secret record, a paper roll is provided at "N," on which the despatcher writes the date and the number of the car before sending it out, and the conductor writes his name after the despatcher has made the required entry. Once in charge of a car, the conductor rings up the fares as usual until the end of the trip, whereupon he turns a crank at the right. This records the end of that conductor's run, and when another takes charge of the car the same operation is repeated. Assuming that the record is 30 when the first man goes on a car and 85 when he leaves it, he would be held responsible for the difference between these numbers, or 55. The second conductor would have to account for the difference between 55 and the highest number recorded at the end of his trip, and so on with all the following conductors until the resetting of the register. It should be noted that this machine is also furnished with a detecting device, which causes a hole to be made on the record every time the register is opened. When the auditing clerk opens the register, this hole is made at the top, but if one should be found anywhere else on the record its location will indicate at once upon whose run the register was tampered with.

IMPROVED GUY ANCHOR

A number of material improvements have been added to the Stombaugh guy anchor, made by W. N. Matthews & Brother, of St. Louis. A new type is shown in the accompanying view. The 5-in. and 6-in. anchors are now made with a square



A COUPLE OF GUY ANCHORS, SHOWING CONSTRUCTION

shank of equal size, permitting the use of the same wrench for both anchors, whereas formerly separate wrenches were necessary. In the past, considerable trouble was caused the users of the 5-in. and 6-in. anchors by defective welds in the rods and eyes. A full rod is now used with no welds. The eye is drop-forged and threaded to the rod. A much larger eye is thus permissible and the eyes are now made amply large to accommodate standard guy thimbles. This eye is made smooth and of such shape as to do away with the absolute need of the thimble.

The hollow shaft is made of seamless square tubing of much greater torsional strength than the old style round tube. It is further reinforced by a malleable iron square key that fits the square shanks of the anchors. This key is brazed on. The handles are attached to a sliding cross that is held at any point on the shaft by means of a non-reversible set-screw. This sliding cross is a great convenience when screwing the anchor into the ground, as the maximum amount of leverage can always be had at all stages of the installation

In installing the anchor, the hollow shaft is slipped over the rod after removing the eye. It is keyed firmly to the square shank of the helix, and the eye is then replaced on the end of the rod. The eye will serve to hold the wrench firmly in place during installation. The handles are then slid down the shaft to a convenient point, and then the anchor is screwed in until the handles get too close to the ground for further manipulation. The set-screw is now loosened and the handles are slid back again to a more convenient position for work, when the process is repeated as before until the anchor is driven in to the required depth. The eye is then removed, the wrench pulled out, the eye replaced, the guy strand is attached, and the pole is anchored securely in a period not exceeding 15 minutes or 20 minutes.

NEW LONDON TUBE OPENED FOR TRAFFIC ON MARCH 10

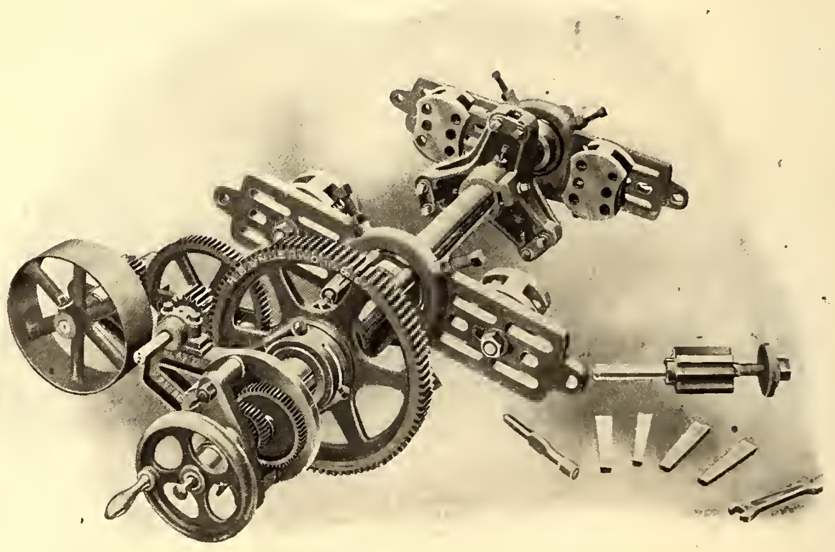
The Baker Street-Waterloo "Tube," one of the late Charles T. Yerkes's London group of railways, was opened to public traffic on March 10.

This is the latest addition to the London under-ground electric railways and a most important link in the solution of the city's traffic problem. The new artery, which is $5\frac{1}{4}$ miles long, runs north and south, traversing all the older lines, with which it is connected by subways.

The construction of the road was commenced in 1898 under the auspices of the late Whitaker Wright's group of roads, and it was subsequently purchased by the Yerkes-Speyer interests. The new "tube" passes under the Thames, 35 ft. below its bed.

A PORTABLE BORING BAR

Among the many railway tools made by the H. B. Underwood Company, of Philadelphia, is a portable tool designed for general boring, and made in several sizes. With this tool all kinds of engines, steam hammers, pumps, air compressors, Corliss valves, etc., can be bored in place. It has fixtures for boring (with one or both cylinder heads off) in any position and in very cramped places. It can be readily operated in a space that is large enough to take the piston out of the cylinder. Many times cylinders can be rebored in place in less time than they could be removed from fixed position, leaving all of the steam connections, holding-down bolts, etc., intact. Enough cutter heads are



PORTABLE TOOL FOR GENERAL BORING PURPOSES

furnished with each size bar to bore diameters given for each diameter of bar. These bars are powerfully geared and can be driven by power or hand. Each bar has two changes of feed; the feed screw is steel; the feed nut is also made of steel, cut to insure great wear. A full complement of expanders is sent to fit stuffing-boxes. One set of sample tools and wrenches is furnished with each outfit. The company is prepared to make special sizes of this machine to suit requirements.

FINANCIAL INTELLIGENCE

WALL STREET, March 14, 1906.

The Money Market

Greater ease has characterized the local money market during the past week, rates for all maturities ruling somewhat below those recently quoted. The heavy liquidation in stocks last week has left stock commission houses fairly well supplied with funds, making it unnecessary for them to borrow in the open market, and the easier tendency which has prevailed was due almost entirely to the extremely light demand, rather than to any pressure of funds by the banks or individual lenders. There were a number of other developments that worked in favor of lower rates, the most important of which was the placing of $10,000,000 Government funds with the depository banks here and at the principal interior points, the decline in sterling exchange to about the lowest point of the year, which enabled a local institution to engage $1,250,000 gold in the London market for import to this side, and the decidedly favorable exhibit made by the bank statement published last Saturday. Local bankers, however, were not inclined to offer with any degree of freedom, the belief being quite generally that no material reduction in interest charges will take place until money begins to return from the interior to this center. At the present time the demand for funds at the principal cities West and South, in connection with the spring trade, is still urgent, and is likely to continue so for several weeks to come. The importation of gold, above referred to, was followed by a hardening of discount rates at London, which was reflected in an advance of 3/4 cent on the pound in sterling rates here, and which prevents the further importation of the precious metal at this time. Discount rates at Berlin also displayed a hardening tendency, due largely to the uncertainty regarding the final outcome of the Algeciras negotiations. The Paris market, however, has ruled somewhat lower, the discount rate being quoted at 2 5/8, a decline of 1/8 per cent. Government finances continue to improve. Receipts are in excess of expenditures, and Treasury officials are of the opinion that the surplus for the current month will reach $2,000,000. The bank statement, published on the 10th inst., was far more favorable than was anticipated. Loans decreased $21,259,200, due to liquidation in stocks and to operation of foreign bankers in the local money market. Cash decreased $5,448,300, which was considerably more than was indicated by the preliminary figures, but as the reserve required was $6,903,250 less than in the preceding week, the surplus reserve was increased by $1,454,950. The total surplus reserve now stands at $6,463,700, as compared with $9,278,150 in 1905, $29,937,075 in 1904, $1,024,000 in 1903, $3,112,900 in 1902, $10,002,000 in 1901, and $5,676,375 in 1900.

Money on call has loaned at 6 per cent and at 3 1/2 per cent, the average for the week being about 4 1/2 per cent. Sixty and ninety-day contracts have been made at 5 1/4 and 5 per cent, while five and six months' maturities were obtainable at 5 per cent. Commercial paper has ruled quiet and somewhat easier, in sympathy with the lower time loan quotations, choice double names being quoted at 5 and 5 1/4 per cent.

The Stock Market

The most important events of the week as bearing upon the stock market were the announcement that $1,250,000 gold had been engaged abroad for shipment to this country, and the positive refusal of the Anthracite coal operators to accede to any and all of the demands made by their employees. Ordinarily, the publication of any such momentous news as this would have exerted a considerable influence upon security values in general, the one announcement for good and the other for evil. In the present instance, however, the market was little affected by either of the developments referred to, and throughout the greater portion of the week speculation was light and of an almost wholly professional character. The adverse decision of the United States Supreme Court in the trust investigation and Chicago traction cases, together with the uncertainty felt concerning the outcome of the Moroccan conference, although London was a considerable buyer of some of its favorites here, held buying for the long account in check. At the same time, however, there was a marked absence of selling pressure. This left speculation entirely at the mercy of the professional room traders, and in consequence thereof fluctuations in prices were of an irregular character.

The bearish contingent selected Reading and Amalgamated Copper in an endeavor to force down prices of the general list, believing these stocks to be the most vulnerable, the one because of the threatened strike, and the other because of reports of shutting down of the mines in Montana, on account of unusually severe weather. In neither case, however, was any serious decline brought about, principally for the reason that the general sentiment is that even if there is a strike in the Anthracite coal fields it will do no particular harm to the companies, while in the case of Amalgamated Copper its refusal to yield to bearish manipulation is accounted for by the continued strength of the copper metal market, as indicated by a further advance in prices of 1/8 per cent per pound. Although, as before stated, the general movement of prices was irregular, the tendency appeared to be upward, and in a few exceptional cases pronounced strength was developed. This applies with particular force to the shares of several Southern companies, both railway and industrial, and is explained by the unprecedented business which is now being done by practically all enterprises in that locality. Other notably strong features included some of the Vanderbilt properties and the smelting and lead stocks, which is attributable to a revival of the deal rumors in existence some time since.

Generally speaking, the local traction group was quiet. This was especially true of all the Interborough and Metropolitan securities, the reason for this being a general disposition to await some tangible developments concerning the pending merger. In the case of Brooklyn Rapid Transit, however, considerable activity developed, and on what appeared to be what the street usually described as good buying, the stock showed considerable strength. The exceptional weather conditions, with the promised unusually early opening of the seaside resorts, would appear to be sufficient explanation for the buying of this stock; still, in addition thereto, there was a recurrence of the old-time stories of a purchase by Pennsylvania interests and of the securing of control by the Rapid Transit of its only formidable competitor.

Philadelphia

Although dealings in the traction stocks have been comparatively small during the past week, they have been accompanied by a higher range of values, and in several instances prices scored sharp advances. Philadelphia Company's shares again led the list in point of activity, about 1500 shares of the free common stock selling at 51 1/4 and 51, while upwards of 12,000 shares of deposited stock changed hands at 53 5/8 to 53 7/8. The preferred stock sold to the extent of about 1200 shares, at from 50 to 50 1/4. Philadelphia Rapid Transit was quite active and strong. In the early dealings rose from 30 7/8 to 32 5/8, on comparatively light purchases, but during the last half of the week there was a gradual decline to 31 1/2, the latter price, however, representing a gain for the week of a full point. A conspicuous feature of the trading was the strength in Fort Wayne & Wabash Traction stocks, the common rising 2 1/4 points to 29, on the exchange of 500 shares, while the preferred rose to 68, on the purchase of 300 shares, an extreme gain for the week of 18 points. Philadelphia Traction was strong. Opening at 101 5/8, the price dropped to 100 and 100 1/8, ex the dividend of $2 per share. Other transactions included American Railway stock at 51 1/2, American Railway warrants at 1 1/4 and 1 1/2, Consolidated Traction at 82 and 81 3/4, Railways General at 7, Union Traction at 63 1/4 to 63, United Companies of New Jersey at 269, United Traction of Pittsburg preferred at 49 7/8, United Railway Investment of San Francisco preferred at 92, and Fairmount Park Transportation at 20.

Chicago

The market for street railway issues at Chicago was more active, but weaker, trading and prices being influenced by the decision of the United States Supreme Court in the franchise litigation. At first the decision was construed as a victory for the railway companies, but later, when the details of the decision were received, showing a victory for the city, prices for all issues crumbled away. Chicago City Railway, after selling at 193 1/2, dropped to 170, ex the dividend, on sales of 216 shares, and at the close 150 was bid for the stock. West Chicago dropped from

50 to 38, and rallied to 40, while North Chicago, after selling as high as 85, declined, too, and closed at 57. Chicago Union Traction common broke from 13¼ to 6, on sales of about 1000 shares, and the preferred sold at 27. West Chicago first mortgage bonds, which sold early in the week at par, were 95 bid, while the consolidated 5s were 80 bid. The 4½ per cent bonds of the Chicago Consolidated Traction Company were 45 bid and offered at 60. Other transactions included Chicago & Oak Park Elevated preferred at 26 and 25, the common at 7 and 6⅞; Northwestern Elevated preferred at 65, South Side Elevated at 94 and 95, Metropolitan Elevated common at 28 and the preferred at 68⅛.

Other Traction Securities

The traction issues at Baltimore were quiet but firm. United Railway free common stock sold at 17¾ and 18¼ for about 2000 shares, while receipts representing about 1000 shares of deposited stock brought 18¾. The bonds were comparatively quiet, the 4s selling from 92¼ to 93 and back to 92½. The free incomes at 74⅜ and 73⅛ and 73¼, while the pooled incomes changed hands at 73¾ and 73⅞. Norfolk Railway & Light 5s were a shade easier, about $25,000 selling at from 100½ to 100. Other sales were: North Baltimore Railway 5s at 120, Lexington Street Railway 5s at 104½, Baltimore City Passenger 5s at 106, Washington City & Suburban 5s at 105, and Citizens Railway & Light of Newport News 5s at 88½. The Boston market was quiet but generally firm. Boston Elevated rose from 154 to 154¾. Boston & Worcester common after selling at 32½ ran off to 30½, but recovered later to 31. The preferred was strong, with sales at 80½ and 81. Massachusetts Electric sold at 18¾ and 19, and the preferred rose from 68 to 68¾. West End common and preferred were comparatively active, the first named selling at 100 and the preferred at 114¾ and 114. In the New York curb market the Interborough stocks ruled firm. Interborough Rapid Transit sold to the extent of 1000 shares at 228½ to 229½ and back to 229. Interborough-Metropolitan common advanced from 51½ to 53¼, and closed at 53⅛, after sales aggregating 20,000 shares. Interborough-Metropolitan preferred sold from 89½ to 87½ for about 6000 shares, and about $350,000 of the 4½ per cent bonds brought prices ranging from 90¾ to 90½. New Orleans Railway common lost ¾, 1600 shares changing hands at 36¾ to 36, and $30,000 of the 4½ per cent bonds brought 91 and 90⅞.

Security Quotations

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

	Mch. 7	Mch. 14
American Railways	51½	51¼
Boston Elevated	154	154½
Brooklyn Rapid Transit	79⅝	84⅞
Chicago City	—	*a199
Chicago Union Traction (common)	—	7½
Chicago Union Traction (preferred)	—	—
Cleveland Electric	—	80
Consolidated Traction of New Jersey	81	82
Detroit United	97¼	99½
Interborough Rapid Transit	228	228½
Interborough-Metropolitan Co. (common), W. I.	51	52⅞
Interborough-Metropolitan Co. (preferred), W. I.	88	88½
Interborough-Metropolitan Co. 4½s, W. I.	90½	90½
International Traction (common)	37¼	—
International Traction (preferred) 4s	73½	—
Manhattan Railway	156½	158
Massachusetts Elec. Cos. (common)	18½	19
Massachusetts Elec. Cos. (preferred)	67	60
Metropolitan Elevated, Chicago (common)	28	26½
Metropolitan Elevated, Chicago (preferred)	68	68
Metropolitan Street	115	115
Metropolitan Securities	71¼	72¼
New Orleans Railways (common)	35½	35¾
New Orleans Railways (preferred)	80½	82¾
New Orleans Railways, 4½s	89½	89
North American	98¼	99⅞
North Jersey Street Railway	27½	27
Philadelphia Company (common)	50⅞	51
Philadelphia Rapid Transit	30½	30⅞
Philadelphia Traction	101	*100
Public Service Corporation 5 per cent notes	94½	95½
Public Service Corporation certificates	72	74
South Side Elevated (Chicago)	93	94½
Third Avenue	132½	132
Twin City, Minneapolis (common)	116½	117¾
Union Traction (Philadelphia)	63	63
West End (common)	99½	99½
West End (preferred)	114	114

* Ex-dividend. a Asked. W. I., when issued.

Iron and Steel

According to the "Iron Age," the returns from the coke blast furnaces show that the capacity of the furnaces in blast on March 1, was 479,739 gross tons per week, as compared with 482,156 gross tons per week on Feb. 1. During February the furnaces of the steel companies did not produce as heavily as expected, making only 1,216,760 tons, while the Merchant furnaces produced 677,272 tons, making a total for the short month 21,894,032 tons, as compared with 2,068,893 tons in January, the record month. Partial reports indicate that stocks are still falling off slightly in the Northern districts. The uncertainties as to full supply are having a considerable effect upon the pig iron markets. Current business in pig iron is limited to early requirements. The steel rail trade continues the banner branch of the industry, and some very good inquiries have appeared. The demand for structural material is very heavy.

WORCESTER SALE TALK REVIVED

Periodically for some time past the rumor has been revived that the New York, New Haven & Hartford Railroad, through the Consolidated Railway Company, was negotiating for the purchase of the Worcester Consolidated Street Railway Company. A story in circulation in financial circles at this time is to the effect that an offer has been made to the trustees of the Worcester Railways & Investment Company for the taking over of the property at $105 a share. The Worcester Railways & Investment Company, it will be remembered, is the holding company for the railway. The State Mutual Life Insurance Company, Metropolitan Life Insurance Company, the Deweys and the Bullocks are said to control the property through ownership of stock. One source of information has it that already a large block of the stock has been acquired, and that the holdings of one other interest are necessary to a change of control. An increase within two weeks of ten points in the stock, from 90 to 100, bears out the statement that developments are to be expected soon.

THE ELECTRIC RAILWAYS OF CANADA

According to the official Canadian report on the subject there were 793 miles of electric railroad in Canada on June 30, 1905. The increase during the year was 36 miles. The total paid-up capital of all the companies was $61,033,321. The consolidated income account of all the electric railroads of Canada for the year ended June 30, 1905, with the increases over the preceding year, is as follows:

	1905	1904
Gross earnings	$9,357,125	$8,453,609
Operating expenses	5,918,194	5,320,527
Net earnings	$3,438,931	$3,133,082

The number of passengers carried by all the electric roads during the year was 203,467,317, an increase of 22,777,319. The freight carried amounted to 510,350 tons, showing an increase of 110,189 tons.

Below are shown the number of passengers carried in some of the larger cities for the year:

City—	Passengers Carried
Montreal (three companies)	67,297,268
Toronto (three companies)	65,792,792
Ottawa	9,328,690
Quebec	5,558,110
Hamilton (four companies)	6,396,419
Winnipeg	11,255,967
London	4,812,520
Halifax	3,540,310
St. John	2,680,601
Vancouver, Victoria and New Westminister (one company)	10,352,410

The total car mileage for the year was 45,959,101, an increase of 3,982,977.

Fifty-six people were killed by the street railways and 1269 were injured.

SUPREME COURT DECISION IN CHICAGO CASE

The Supreme Court of the United States announced its decision on Monday, March 12, in what is known as the Chicago Traction cases, involving the time the charters of the Chicago street railways expire. Only a synopsis of the opinion was given, this being read by Justice Day. It reverses the opinion of the lower court in some particulars, and affirms it in others. The Circuit Court of the Northern District of Illinois held that as to several of the roads their charters would not expire until 1958, others in 1906, and that still others had already expired. The Supreme Court upholds the constitutionality of the ninety-nine year law, and concedes that the act of 1865 extended the corporate lives of the old companies, which were originally twenty-five years, to ninety-nine years. It denies, however, that the act granted the companies rights in any streets for that length of time. The court holds that the companies which operate lines in certain west and south side streets specified in the original ordinance have a right to use them until the city shall purchase the tangible property used in the construction or operation of the lines. That is the condition found in the ordinance of 1858, and the Supreme Court holds that that ordinance was confirmed by the act of 1865. In the matter of grants of street railway privileges made by the annexed towns of Jefferson and Lake View, it is held that they do not extend beyond the life of the corporation making them. A synopsis of the decision follows:

1. The Circuit Court of the United States for the Northern District of the State of Illinois had jurisdiction to render judgments against the Chicago Union Traction Company, the North Chicago Street Railroad Company and the West Chicago Street Railroad Company, set up in the bills afterward filed for the appointment of receivers.

2. The proceedings for the appointment of receivers were not shown to be conclusive and fraudulent, and the court had jurisdiction to entertain the bills and appoint the receivers and put them into possession of the property of the railway companies.

3. The ancillary bills filed by the receivers were maintainable in aid of the court's jurisdiction to settle controversies as to the property which was to be administertd and disposed of under the orders and decree of the court.

4. The acts of 1859, 1861 and 1865 were not unconstitutional under the constitution of Illinois of 1848, in force when the same were passed.

5. The acts of Feb. 6, 1865, amending the act of Feb. 14, 1859, had the effect to extend the corporate lives of the Chicago City Railway Company and the North Chicago City Railway Company and the Chicago West Division Railway Company for the term of ninety-nine years. It affirmed the contracts with the city, prescribing rights and privileges in the streets of Chicago in all respects as theretofore made, including time limitations as contained in the ordinance previously passed. It recognized and continued the right of the city and the companies to make contracts for the use of the streets upon terms and conditions, including the time of occupancy, as might be agreed upon between the Council and the corporations.

6. Corporate privileges can only be held to be granted as against public rights when conferred in plain and explicit terms. The ambiguous phrase in the act of 1865, "during the life hereof," did not operate to extend existing contracts for the term of ninety-nine years, or limit the right of the city to make future contracts with the companies covering shorter privileges.

7. The amending act of 1865 had reference to the North Chicago City Railway Company, as well as the corporations specifically named in the first sections of the acts of 1859 and 1861.

8. The ordinances of May 23, 1859, granting rights and privileges in certain streets to the Chicago City Railway Company and the North Chicago City Railway Company, respectively, are radically different. The grant to the former company for the south and west divisions of the city is during all the terms specified in the act of Feb. 14, 1859, which act expressly ratified the ordinances of 1858, granting the right to use the streets therein named for the term of twenty-five years and until the city shall purchase and pay for the same as set forth in said ordinance. On the North Side the term granted is for twenty-five years, "and no longer."

The privileges conferred upon the Chicago City Railway Company and its grantee were confirmed as made by the act of 1865, with the effect to confirm the right of the companies to occupy the streets named in the ordinances of 1858, May 23, 1859, and similar ordinances for the term of twenty-five years and until the city shall elect to purchase and pay for the property of the said railway companies.

On the North Side, the grants being limited to twenty-five years and no longer, no such right exists to remain in the use of the streets until purchased by the city.

9. Whatever rights existed in the streets were not lost to the companies by the acceptance of the ordinances granting a change from animal to cable or electric power in the operation of the railways.

10. The grants in the town of Jefferson having been made after the acceptance of the city's and village's act, are limited to the term of twenty years.

11. The grants by the Supervisors of Lake View are not in perpetuity, as the Lake View Road was but an extension of the North Side system, which was expressly limited in the duration of its grant to the term of twenty-five years. No intention will be presumed to make an extension of this part beyond the life of the grant to the main line of the North Side Road.

12. The grants by the Trustees of Lake View will not extend beyond the life of the corporation making them, and upon the annexation of the town of Lake View to Chicago the further right to use the streets must be derived from the grants by the Council of that city under the power conferred by the cities and villages act.

The decree is reversed and cause remanded for further proceedings, in accordance with the views herein expressed.

Justice McKenna delivered a dissenting opinion, concurred in by Justices Brown and Brewer.

In order better to convey the significance of the decision, it has seemed advisable briefly to review the history of the traction situation. Street railroading in Chicago had its beginning in August, 1858, when the Chicago Common Council passed an ordinance granting to Frank Parmlee and his associates the right to lay tracks and operate a street car system on certain streets in the south and west divisions. A year later, Mr. Parmlee and his associates were incorporated as the Chicago City Railway Company, and shortly afterwards the Council gave to that corporation the right to extend its lines over a number of other streets in the same two divisions. Both this second ordinance and the first one provided that "the right to operate said railways shall extend to the full time of twenty-five years from the passage hereof, and at the expiration of said time the parties operating said railways shall be entitled to enjoy all said privileges until the Common Council shall elect by an order for that purpose to purchase said tracks of said railways, its cars, carriages, station houses, station grounds, depot grounds, furniture and implements of every kind and description used in the construction or operation of said railways, or any appurtenances in and about the same.

Other ordinances were passed by the Council for several years, practically based in regard to the limit of time upon the first one. In July, 1863, the City Railway Company sold out all its rights in the west division lines, and in certain east and west lines on the south side, like Madison, Randolph and Lake Streets, to the Chicago West Division Railway Company, which, of course, succeeded to the rights and limitations of the Chicago City franchises. Thereafter, separate ordinances were passed for the City Company and the West Side Company, most of which were mere amendments to the original ordinance.

On Feb. 6, 1865, the Legislature passed a law, which since has become famous as the "ninety-nine year act." The old City Railway Company had been incorporated for a term of twenty-five years. The act of 1865 extended the term of incorporation of the street car company to ninety-nine years.

The companies, soon after the passage of this act, set up the claim that it not only extended their corporate life, but also extended their franchises to the same degree. Furthermore, they held and always since have insisted that the effect of the ninety-nine year act by the Legislature was to render null and void all the limitations as to time in any further ordinance, so that the right to use the streets must be terminated by the corporate life of the company, and not by the limitations fixed by the City Council.

The City Railway Company has retained its independent corporate existence on the south side. The West Division Company, through Charles T. Yerkes, has been merged into the north side company under the name of the Union Traction Company, Both the City Railway Company on the south side and the Union Traction Company, which covered the rest of the city, held to their original contention that the ninety-nine year act extended to all franchises.

The city from the outset denied this, and persisted in putting limitations of time in all the ordinances. The contentions were fought out in one way or another until finally Judge Grosscup, in the United States Circuit Court, rendered a decision which now is upset by the Supreme Court. Judge Grosscup decided in favor of the companies in regard to all ordinances and franchises in existence prior to May 3, 1875, which was the date of the adoption of the cities and villages act under the Illinois Constitution of 1870. He held the ninety-nine year act of 1865 extended the life of all ordinances, and took away from the Council the right to limit a franchise, giving it privileges which were merely administrative. This view he applied to everything until the vote at the charter election in 1875, at which time he declared the people gave back to the City Council absolute control over the conditions of the street car franchises.

MORE ABOUT THE SOUTH JERSEY & SEASHORE ELECTRIFICATION

At the meeting of the stockholders of the West Jersey & Seashore Railway Company, held last week, the increase in the capital stock of the company from $8,076,000 to $10,000,000 was authorized, this additional amount to be used in paying part of the expense of equipping the line with electricity between Philadelphia and Atlantic City. The annual report of the company for the year was presented, and some remarks were made by President A. J. Cassatt of the company regarding the details of the change of motive power that are of especial interest at this time. These remarks were confined to terminal facilities, details of line construction and operating plans, and supplement the information given previously in these columns regarding the electrical equipment.

The plans contemplate a terminal adjoining the present ferry terminal in Camden, opposite Philadelphia, and a double-track overhead line thence to Haddon Avenue station, where a connection will be made with the present tracks on the surface. From that point the line will be double tracked with 100-lb. rail to Newfield, and from Newfield to Atlantic City with 85-lb. rail. That part of the Cape May division from Newfield to Millville will also be electrified and a single-track railway laid with 100-lb. rail.

To avoid crossing the Atlantic City Railroad at grade, the Newfield branch, from a point at or near the Meadows Tower, about 2 miles from the present Atlantic City terminal, will be extended and double tracked, crossing the thoroughfare on a new drawbridge between the present bridge, used by the main line, and the old drawbridge. After passing the thoroughfare, the tracks will cross over and above the Atlantic City Railroad and join the present right of way in Atlantic City near Ohio Avenue, and will thence parallel the present tracks to a point south of the present terminal in Atlantic City, where a new terminal will be located facing on Atlantic Avenue and lying between Tennessee and New York Avenues. The service from Camden to Woodbury will be by an overhead trolley line, and from Woodbury to Atlantic City by the third-rail system; from Newfield to Millville there will be overhead trolley service.

By agreement with the Central Passenger Railway Company, of Atlantic City, and the Atlantic City & Shore Railway Company trackage rights have been granted to the latter company over the South Jersey & Seashore Railway Company's lines between a point of connection with the Newfield branch, at or near the Meadows Tower, and Somers Point via Pleasantville, so as to permit the transportation of passengers between Atlantic City and Somers Point and further aid in the development of the Atlantic City territory, for which privilege the South Jersey Company will receive a satisfactory rental.

STEEL-CAR PLANT OF AMERICAN CAR & FOUNDRY COMPANY AT ST. LOUIS

The American Car & Foundry Company has selected a site in St. Louis for its new plant for the manufacture of steel cars, and has acquired property on Levee and First Streets, between St. George and Lynch Streets, in South St. Louis. This plot is 1200 ft. in length and 300 ft. in width, extending on the levee side from St. George Street to a point beyond Lynch Street and near Dorcas Street, and on the First Street side from St. George Street to Lynch Street. The main building, which will be constructed of steel, will be 800 ft. long by 180 ft. wide. There will be additional small structures, as well as yards, supplied with all necessary facilities. The new plant will practically be an addition to the existing South St. Louis factory. The new buildings and ground will cost $1,000,000. This factory will employ about 1000 men. With the force employed in the existing factory, the company will have about 4000 men in the South St. Louis plants. The company has plants at Madison and St. Charles, as well as at other places in different parts of the country.

CHANGE IN DATE OF MEETING OF SOUTHWESTERN ASSOCIATION

The date of the meeting of the Southwestern Electrical & Gas Association has been changed from the second Tuesday in May to May 16, 17 and 18, at Galveston, Tex. Frank J. Duffy, of Beaumont, Tex., is secretary of the association.

JERSEY FREIGHT BILL PASSES SENATE

The electric railway freight bill, introduced in the New Jersey Legislature, has passed the Senate and will go to the House this week, it is expected. A largely attended hearing, at which only two steam railroads were represented, was mentioned in the Street Railway Journal last week. The bill was reported favorably at once and passed without trouble. It will be chiefly valuable to existing country lines operating under street railway or traction charters. New roads, built under steam railroad charters, have freight-carrying privileges. Municipalities will have the right, under the terms of the bill, to permit or refuse the freight-carrying privilege, and to regulate the conditions under which traffic shall be carried on. The Trenton, Lawrenceville & Princeton Railroad, the Trenton & New Brunswick Railroad, the Burlington & Mount Holly, and Bridgeton & Millville Traction Companies (the two latter chartered under a special privilege of the traction act prior to 1895) carry freight, and will not be affected by the law.

MEETING OF UNITED RAILWAYS OF ST. LOUIS

The annual meeting of the stockholders of the United Railways Company of St. Louis, for the election of directors, was held March 5. Two new directors were elected to fill vacancies. They were Charles H. Huttig, president of the Third National Bank, and Christopher D. Smithers, of New York, identified with North American Company interests. Mr. Huttig succeeds the late W. H. Thompson, and Mr. Smithers succeeds Eugene Delano, of New York, who resigned from the board some time ago. The following directors were re-elected: John I. Beggs, of Milwaukee; James Campbell, Murray Carleton, Robert McCulloch, Henry S. Priest, W. V. N. Powelson, Festus J. Wade, of St. Louis; C. W. Wetmore, George R. Sheldon, of New York. The only outside director in attendance at the meeting was Mr. Beggs, president of the company. The 249,000 shares of common stock, held in the voting trust agreement, of which the United Railways owns a majority, was voted in addition to 64,000 shares of preferred stock. The new board will organize and elect officers in about two weeks. The re-election of Mr. Beggs as president and Capt. McCulloch as vice-president and general manager is regarded as certain.

CLEVELAND, ASHLAND & MANSFIELD CONTRACTS TO BE PLACED

The Roberts & Abbott Company, of Cleveland, consulting engineers for the Cleveland, Ashland & Mansfield Railway, expects to close contracts within the next thirty days for the construction and complete equipment of this road. The line will be an extension of the Cleveland & Southwestern Traction Company's system, and it will be largely owned by the Pomeroy-Mandelbaum interests, which control the Cleveland & Southwestern.

The road will extend from the Southern division of the Cleveland & Southwestern at Seville, to Le Roy, Lodi, West Salem, Pope, Nankin, Ashland and Mansfield, a total of 42 miles. Grading will average about 8300 yards to the mile, with comparatively little heavy work, and few bridges. The line will be supplied with power from the main station of the Cleveland & Southwestern at Elyria, where another 1500-kw turbine will probably be installed to assist the two units of that size now in operation. There will be five sub-stations, each having a 300-kw rotary with necessary transformers for stepping the voltage down from 26,500 to 370 volts. One of the sub-stations will be a floater, while the others will be installed in brick buildings containing residence, waiting room, freight room and machinery room. Seven combination passenger, smoker and baggage cars, and one express car will be purchased; they will be equipped with four 75-hp motors and train control system. Track will be laid with 70-lb. rail, and the overhead will be similar to the Cleveland & Southwestern standard. A car house and light repair shop will be built at Mansfield. It is very probable that the entire contract will be let to one company, and the various items sublet through the contractor.

The line will connect at Mansfield with the Ohio Central Traction Company, and it will form part of the through route from Cleveland to Columbus. It is probable that the Ohio Central power will also be supplied from Elyria when the connecting link is completed.

TO GUARD AGAINST ACCIDENTS

An important conference was held at Indianapolis, March 6, by the State Railroad Commission with the signal engineers of the different railroads in the State and officers of interurban roads. The object of the conference was to discuss the subject of "railroad crossings" and the prevention of accidents at crossings by the use of interlocking switches, derails, etc. Previous to the organization of the State Railroad Commission, all interlocking switches, derailing devices, etc., put in at railroad crossings had to be approved by the State Auditor. This authority is now delegated to the Commission. The Commission charged the railroads with having had too many accidents at crossings. These it attributed to several causes, among them the laying of guard rails at the side of the "derails," to prevent the derailing of the train, and the placing of derails 300 ft. from the crossing instead of 500 ft., as prescribed. The signal engineers insisted that derails placed 300 ft. from the crossing were as effective as if placed 500 ft. The Commission intimated that it would rule that all guard rails must be removed except in special cases, where, by permission of the Commission, they may remain.

It was brought out that the law discriminates against interurban roads in the matter of putting in crossings. When an interurban road desires to cross a steam line it must bear the expense of putting in an interlocking switch, but steam roads may cross an interurban road without incurring the cost of such crossing.

The following statistics were recently gathered by the State statistition:

INTERURBAN RAILROAD ACCIDENTS IN 1905

	Killed	Injured
From causes beyond their own control—		
Passengers	0	38
Employees	0	12
All others	1	10
Total	1	60
From their own carelessness—		
Passengers	10	1,869
Employees	3	129
All others	26	2,288
Totals	39	4,288

The amount paid in damages, $96,061.30.

ROCK ISLAND ELECTRIFICATION IN IOWA

The Des Moines, Winterset and Indianola branch of the Chicago, Rock Island & Pacific Railroad, with 48 miles of track, is to be electrified and operated as an interurban road. Plans for the carrying out of this project have been under consideration by the officials of the Rock Island ever since the discontinuance of the interurban service on the line from Des Moines to Indianola last fall. While those interested are not ready to announce all of their plans, enough is known to say that the operating company will be independent of the Rock Island and will operate the line under a long-time lease. The Rock Island will make all the changes necessary on its right of way, such as improving the roadbed, installing the trolley wires and poles and appurtenances. The power and the rolling stock will be furnished by the operating company. The Westinghouse and the General Electric Companies, it is stated, have already made figures on the cost of electrifying the tracks. The move has been taken, so it is said, to protect the Indianola and Winterset property of the Rock Island against deterioration, threatened by the invasion of the territory by interurban lines. The three best cities on these branch lines are now the objective points of three different interurbans. The Des Moines North & South expects to construct a line to Carlisle; the Des Moines & Indianola Interurban will construct a line connecting Des Moines with Indianola, and the Des Moines, Winterset & Creston Company is now making a location survey for a line from Des Moines to Winterset and thence to Creston. The Rock Island has concluded to electrify its branch lines to these towns, so as to be able to compete satisfactorily with the interurban lines, and in order to do this the scheme of resorting to an independent company to operate the lines when electrified was resorted to. This will take these lines out of the Rock Island system, and permit the charging of interurban rates, without subjecting the Rock Island system to the charge of discrimination between stations.

POWER STATION FOR THE NEW YORK, WESTCHESTER & BOSTON

The City & County Contract Company, of 30 Broad Street, New York, which is the constructing company for the New York, Westchester & Boston Railway, has issued specifications for the power plant, which will include steam turbo-alternators with their dependent auxiliaries, twenty-four water-tube boilers with superheaters and their parts, three open exhaust feed-water heaters, six horizontal outside-packed plunger boiler feed pumps, three surface condensers, twenty-four mechanical stokers, and one 60-ton electric traveling crane. Plans and all additional information can be obtained at the office of Wm. A. Pratt, chief engineer, New York, Westchester & Boston Railway Company, 30 Broad Street, New York City, or at the office of L. B. Stillwell, consulting electrical engineer, 100 Broadway, New York City, or Sargent & Lundy, consulting mechanical engineers, Railway Exchange Building, Chicago, Ill.

Bids will be received by T. D. Rhodes, president, the City & County Contract Company, at his office, Room 1516, 30 Broad Street, New York City, on March 24, 1906, up to 12 o'clock noon.

STRANG GASOLINE-ELECTRIC CARS ON TOLEDO LINE

William B. Strang, of New York, whose gasoline-electric car is making a tour across the Continent, announced while in Toledo last Saturday, that cars of this type would be used on the Toledo, Fort Wayne & Indianapolis Railway, which was organized some time ago. W. B. Strang & Company are also stated to be financially interested in the project and to have arranged for the financing and building of the road. The projectors of the road announce that they have secured all the required right of way between Indianapolis and Ft. Wayne, and expect to begin construction work in April, and it is expected that this portion will be ready for operation this year. In the meantime another company will be formed in Ohio to build the Toledo-Ft. Wayne section. The Toledo, Ft. Wayne & Indianapolis Railway Company was formed some time ago with $3,000,000 capital stock. Hon. C. N. Thompson, of Indianapolis, is president of the company; Charles E. W. Coles, of New York, secretary-treasurer, and W. H. Ogden, of Indianapolis, general manager. Joseph A. Vandergrift, who is associated with W. B. Strang & Company, will have charge of the construction. The Strang cars will be used in passenger service, while the freight trains will probably be handled by steam locomotives.

TUNNEL RECOMMENDATIONS IN NEW YORK

The Rapid Transit Commission last week, in a formal communication to the Board of Estimate and Apportionment, recommended a four-track subway branching from the Fourth Avenue-Fort Hamilton line at Thirty-Sixth Street, Brooklyn, and running as a subway to Eighty-Sixth Street and Bay Thirty-Fifth Street, in Unionville, and then as an elevated system across the low-lying ground at the edge of Gravesend into Stillwell Avenue, and down Stillwell Avenue to Surf Avenue, in the heart of the amusement district, in the West End. The subway will cost about $8,000,000. Express trains will make the run from points in Manhattan to Fourth and Atlantic Avenues, in Brooklyn, and then down Fourth Avenue over the route just decided upon at a speed equal to the express service in the subway. Probably the trip will be made from Harlem to Coney Island in about 40 minutes. The route as decided upon taps the Borough Park, Bensonhurst, Bath Beach, Blythebourne, Martense, Lefferts Park and Homewood sections, and will give the people of those localities a much improved service. Whether the Belmont interests build the Fourth Avenue subway to Coney Island or not the Rapid Transit Commission expects to arrange a traffic agreement by which, on the payment of an extra fare, through trains will be run from the Bronx to Coney Island. In effect, the new section will be an extension of the Fourth Avenue and Fort Hamilton subway, the plans for which were approved by the Rapid Transit Commission on July 14 last, and by the Mayor on July 28. This last section is so planned that connections can be made with the subway now under construction, and with the Prospect Park extension heretofore authorized, and also with the Brooklyn and Manhattan loop lines approved by the Commission on July 14 last.

PETITION TO CANCEL LEASES OF THE UNION TRACTION COMPANY, CHICAGO

The North and West Chicago Street Railway companies have filed in the Federal Court a petition for the cancellation of the leases of their properties to the Union Traction Company. Judge Grosscup set May 2 as the date for the hearing of the case. The reasons given by the petitioners for demanding a restoration of their properties are:

That the receivers of the Union Traction Company have violated the terms of the leases in using money to pay the debts of the Union Traction Company when it should have been applied to pay rent.

That these receivers, while acting as trustees for the underlying companies, have loaded them with debts in excess of $3,000,000, and the money obtained has been spent for the benefit of the Union Traction Company.

That the receivers, while obligated under the leases to furnish the money for the improvement of the properties, have used for this purpose money which should have been applied to the benefit of the underlying companies.

That the Union Traction Company is financially and otherwise unable to carry out the terms of the leases, especially in the matter of coming to an agreement with the city, and it should consequently get out of the way so the underlying companies can manage their own affairs.

The petition states that leases were made to the Union Traction Company June 1, 1889. These on July 24, 1903, were modified by mutual agreement. They provided that out of the gross income, the Union Traction Company was to deduct necessary operating expenses and the payment of fixed charges on the underlying companies, and the net income, up to a fixed amount, was to be paid in rentals to the stockholders of these companies, when the residue was to go to the Union Traction Company.

The statement is made that instead of keeping the terms of the leases, $196,416 belonging to the underlying companies was used to pay debts of the Union Traction Company, and that other money belonging to the North and West Side companies was used for the purchase of cars. The further charge is made that, while the receivers were managing the underlying companies, promissory notes to the amount of $1,090,000 in the name of the West Chicago Company and $2,316,000 in the name of the North Chicago Company were discounted, and the money thus raised applied to the benefit of the Union Traction Company, although the underlying companies are held liable for its payment.

In another suit brought by the underlying companies to recover its properties, Judge Grosscup has just overruled the demurrer of the defendants, and the case will now be tried on its merits.

This suit was brought by the North and West Chicago Street Railway companies Dec. 1, 1904, against Charles T. Yerkes, the receivers of the Union Traction Company, and the trust company and bankers involved, and the suit will now be tried on its merits. The object of the suit is to recover for the plaintiffs the outlying traction companies which Mr. Yerkes built and merged into the Consolidated Traction companies.

RESIDENTS FAVOR ELECTRIFYING EVANSTON BRANCH OF THE CHICAGO, MILWAUKEE & ST. PAUL RAILROAD

The ordinance before the City Council to permit the Chicago, Milwaukee & St. Paul Railroad to equip the Evanston branch from Wilson Avenue to the city limits for electrical operation is indorsed by the North Shore Improvement associations, representing the residents of the suburbs through which the road passes. The objections to the ordinance are said to be largely from real estate men and property owners near the present terminal of the Northwestern elevated at Wilson Avenue. As the ordinance now stands, it permits the St. Paul Railroad to operate three tracks by electricity at the present time. Elevation of the tracks must be begun in seven years and completed in ten years, and when the elevation is completed six tracks may be operated, two of which may be used for freight. The part of the ordinance to which the railway company objects is the clause giving the city the right to limit the Northwestern elevated trains on the loop and compelling the company to establish terminals north of the Chicago River for the accommodation of passengers who may come over the new road from the outlying towns. The matter will come before the Council on Monday, March 19.

ANOTHER CAR HOUSE BURNED IN NEW YORK

Another car house of the New York City Railway Company was destroyed by fire last week. This was the building of the company at Eighth Avenue and Fiftieth Street, occupied jointly by the company and the New York Transportation Company, operating an electric cab service throughout the city. The fire occurred on Saturday afternoon, during a severe wind storm, and reduced the building to ashes. The ground floor was used by the street railway company for the storage of cars, while the remainder of the building was used similarly for storage purposes by the Transportation Company. The cars were accessible, so after the fire began little difficulty was experienced in running them into the street. With the cabs, however, the task was not so easy, and the work of salvage had to be abandoned with fifty still in the building.

NEW YORK CITY RAPID TRANSIT BILL REPORTED TO THE SENATE

After a session lasting until nearly midnight, the cities committee of the Senate, Tuesday, March 13, reported out the Elsberg Rapid Transit bill in amended form, and it is likely to be passed as amended. The changes in the bill, to which all the contending interests agreed, make the clauses concerning the manner of letting of contracts for the construction, operation and maintenance of new subway routes permissive instead of mandatory. There is, however, this exception, that the manner of letting the contracts is put up to the Board of Estimate and Apportionment, which shall say in the first instance whether it is expedient and in the public interest for the contracts to be let singly or together. Then the Rapid Transit Commission takes hold and follows the plan laid down by the Board of Estimate. Another feature of the measure does away with the self-perpetuating character of the Rapid Transit Commission, in that all vacancies on the board are filled by the Mayor.

GENERAL OFFICE FOR STONE & WEBSTER IN TACOMA

Stone & Webster, of Boston, whose property interests in the Far West include the Seattle Electric Company, the Puget Sound Electric Company, the Tacoma Railway & Power Company, the Puget Sound Power Company and the Whatcom County Railway & Light Company, all in Washington, have opened a suite of offices in the Pioneer Building, First Avenue and James Street, Tacoma, which will be in charge of Jacob Firth, as resident manager. Mr. Firth now is president of the Seattle Electric Company and of the allied corporations, and is also president of the Puget Sound National Bank. H. F. Grant, general manager of the Seattle Company, will have offices with Mr. Firth, and will be considerably relieved of the details of the management of that property through the appointment of J. B. Lukes to the position of general superintendent of the company. Heretofore Mr. Lukes has been superintendent of lighting and power of the company.

NEW ROAD OUT OF WASHINGTON

The Great Falls & Old Dominion Railway, extending out of Washington, was opened to traffic Wednesday, March 7.. The road eventually will extend from Georgetown, Washington, to Great Falls, but at present is operated only to Difficult Run. After crossing the Aqueduct Bridge at Georgetown the line pushes its way in a southwesterly direction over hills and through filled gullies, which form a typical "Old Dominion" landscape, every spot of which teems with history. One of the features of the route is the trestle 1½ miles from Great Falls. This structure, which is 600 ft. long and more than 70 ft. high, spans a deep gully, through which flows a small stream. The power house is located on the south bank of the Potomac, near the Aqueduct Bridge. A feature of the equipment is the use of Westinghouse-Parsons turbine units. The car house, built of reinforced concrete, is located in Rosslyn. The rolling stock of the company consists of five passenger coaches and a baggage car. The cars are painted a bright yellow, and the interiors are finished in light maple, with rattan seats. They are 42 ft. long and seat forty-two persons. Each car is equipped with four 50-hp motors.

The system of fares is unique among suburban lines. The route has been divided into four sections. The terminal of the first is at the border line of Alexandria County, Va.; the second ends at the Falls Church Chain Bridge Road; the third at the Lewinsville Road, and the last at Great Falls. Six tickets will be sold for 25 cents, and a ticket is required for each division. City car tickets will also be accepted, and transfers will be given by and will be accepted from the Capital Traction Company.

MORE JOHNSON BILLS IN OHIO

Not daunted by his recent failure to get through the Ohio Legislature the bill introduced by Representative Metzger, which would have virtually given Johnson's so-called 3-cent fare company a free hand in Cleveland, Mayor Johnson has introduced two new street railway bills. A new bill by Metzger seeks to accomplish the same ends as the former bill, but by other means. The bill provides that City Councils shall advertise for bids for street railway franchises, and then submit all bids, after they have been incorporated into ordinances, to the vote of the people. It provides that tracks shall not be laid until there have been filed the consents of a majority of the property owners on a street; such consents once given cannot be withdrawn, and the failure of a company to obtain a majority of consents on a street or part of a street shall not invalidate the grant, insofar as it relates to other streets where a majority of consents have been secured. On streets where tracks are already laid it shall not be necessary to obtain consents, unless it is desired to lay additional tracks. Under this provision a Council can grant franchises on streets where existing franchises have expired without the necessity of obtaining the consents of property owners.

Another Johnson measure provides that a municipality may issue bonds for the purpose of acquiring a street railway system, and that such bonds shall not be a lien upon the credit of the city, but only upon the street railway property. In the event of a foreclosure of a mortgage on a municipally-owned street railway, such foreclosure shall carry with it a twenty-five-year franchise, but the terms and conditions of such franchise shall be fixed in the ordinance at the time the bonds are issued.

IMPROVEMENTS IN TACOMA AND SEATTLE

W. S. Dimmock, general manager of the Puget Sound Electric Railway Company and of the Tacoma Railway & Power Company, has been in the East during the last week or two, arranging for important improvements and extensions to those railways. The interurban line will be extended to American Lake, Olympia and Summit, and a considerable amount of double track will also be laid. Practically all of the lines in South Tacoma will be equipped with double track, and nearly all the lines in Tacoma are to be paved. Twenty-five new 50-ft. passengers cars have been ordered from the St. Louis Car Company, and fifty new freight cars have been purchased. One new large sub-station will also be erected. Mr. Dimmock reported that the business conditions in the Northwest were excellent, and that both Seattle and Tacoma are growing rapidly.

INTERURBAN ENTRANCES INTO CHICAGO

If the plans under consideration for extension of elevated lines of Chicago to connect with suburban and interurban lines for the building of an elevated structure over the Rock Island tracks for electric cars, and for the operation of electric cars over the Chicago & Northwestern tracks to connect with the Northwestern Elevated are carried out, the outlying districts on all sides of Chicago will have rapid transit facilities to the heart of Chicago. Ordinances are now before the Council for the extension of the Humboldt division of the Metropolitan elevated from its present terminus near Lawndale Avenue to the city limits at Seventy-Second Avenue, and for an extension of the Douglas Park division to Forty-Sixth Avenue.

It is proposed to connect the extended Humboldt division with interurban lines much in the same manner that the Aurora, Elgin & Chicago electric line operates over the tracks of the Metropolitan system. Interurban and suburban lines would also be connected with the extension of the Douglas Park division.

The ordinance of the Chicago, Milwaukee & St. Paul Railway permitting the connection of its Evanston branch with the Northwestern Elevated if passed, will provide for entrance into the city of electric cars from the north. The plan is to provide the tracks of the steam road north of Wilson Avenue, the present terminus of the Northwestern elevated, with an overhead trolley. At Wilson Avenue an incline will bring the electric cars on the elevated structure and upon this they will be carried to the business district. Such an arrangement would probably give entrance into the city to the Chicago & Milwaukee electric line, which now terminates at Evanston.

A third plan, said to be under consideration, is to build an elevated structure for electric cars over the Rock Island and Lake Shore tracks. This would give entrance to interurban lines from the south.

CONSOLIDATION OF SPOKANE COMPANIES

Jay P. Graves, of Spokane, has effected the consolidation of the Spokane & Inland, the Spokane & Coeur d'Alene, the Spokane Traction Company, and the Spokane Terminal Company, with which he is associated, as the Inland Empire Railway Company. The Spokane & Couer d'Alene was backed originally by Mr. Blackwell, of Spokane, who is president of the Howard Lumber Company, and controls large timber tracts in Idaho. The Spokane & Inland is under construction and runs southeast from Spokane into the Palouse Country. It is projected for a distance of about 140 miles, part of which is under construction. It will serve territory in which the Potatch Lumber Company operates extensively. The Spokane & Inland will use electricity for its day traffic, and expects to haul timber and lumber at night with steam power. It has a contract with the Washington Water Power Company for electric power. The Spokane Traction Company has about 13 miles of street railroad in Spokane. It receives its power also from the Washington Water Power Company, not now identified with the Graves interests. Mr. Graves, it is also announced, however, has secured water power on the Columbia River at Kettle Falls, 75 miles from Spokane, where 100,000 hp is available. The officers of the Inland Empire Company are: Jay. P. Graves, president; F. Lewis Clark, vice-president; F. A. Blackwell, chairman of the board of directors.

TERMS OF THE CHICAGO & MILWAUKEE ELECTRIC RAILWAY FRANCHISE IN MILWAUKEE

Mention was made in the STREET RAILWAY JOURNAL for March 10, of the fact that the Chicago & Milwaukee Electric Railway Company had secured a franchise to enter Milwaukee. The franchise is limited to thirty years, and permits the laying of a double track from the south limits to the center of the city. The line will terminate in a loop, enclosing one block, the tracks being laid on Sixth, Cedar, Seventh and Wells Streets. The franchise permits the operation of local, as well as interurban cars, and provides for the carrying of baggage and express matter. A terminal building to facilitate the handling of freight, and to serve as a passenger station will be built at some point on the loop.

The only compensation asked for by the city is that the railway company pay $1,000 towards the construction of a viaduct over the tracks and yards of the Chicago, Milwaukee & St. Paul Railway, provided the city loses its cases against the railway, now before the Supreme Court, to compel the latter to build the viaduct. The electric railway company further agrees to repair the streets for a distance of 1 ft. on each side of its tracks.

The sentiment in Milwaukee in favor of the granting of the franchise was so strong that after the ordinance for the franchise was presented, it was obtained in the minimum time permitted by the State laws and city charter. It was presented Jan. 8, and was passed Feb. 27. It is interesting to note that petitions were presented signed by the property owners on each of the two parallel streets considered as a route for the electric line, asking that the tracks be laid on their street.

Within a year the company will be operating cars from Evanston, the southern terminus of the road, into the business district of Milwaukee. It is expected that the total distance, 74 miles, will be made in 2¼ hours. The fact that with the exception of a distance of 2 miles, the tracks will be laid on a private right of way, and that the tracks are double the whole distance will make possible the high scheduled speed.

Should the ordinance pass that is now before the Chicago City Council to permit the Evanston branch of the Chicago, Milwaukee & St. Paul Railway to be equipped for electrical operation, the trip from the business district of Milwaukee to the loop district in Chicago could be made by electric cars with only one change, this at Evanston, where the two lines connect.

ANNUAL MEETING OF IOWA STREET & INTERURBAN RAILWAY AND IOWA ELECTRICAL ASSOCIATIONS

The annual convention of the Iowa Street & Interurban Railway Association will be held in Des Moines, April 19 and 20. Kirkwood Hotel will be the official headquarters of the association. At the meeting papers will be presented on "Standard Car and Truck Construction for Street and Interurban Work," "Discipline of Car-Service Employees," "Comparative Value of A. C. and D. C. Systems of Distribution for Railway Work." In addition there will be other papers devoted to electric railway practice. The Iowa Electrical Association will hold its annual meeting at Des Moines on April 18 and 19. Both associations extend a hearty invitation to the trade to attend.

GEORGIA RAILWAY & ELECTRIC REPORT

The Georgia Railway & Electric Company has issued its pamphlet report for the year ended Dec. 31, 1905. The company controls the street railway, electric light, power and steam-heating facilities of the city of Atlanta and Fulton County, Ga. The income account for the year ended Dec. 31 compares with that of the previous years as follows:

	1905	1904
Gross earnings	$2,500,574	$2,112,973
Operating expenses	1,216,032	1,088,081
Earnings from operation	$1,284,542	$1,024,892
Taxes	100,664	72,560
Net earnings	$1,183,877	$952,332
Charges	513,304	497,856
Balance	$670,573	$454,476
Preferred dividends (5 per cent)	120,000	120,000
Balance	$550,573	$334,476
Common dividends (2 per cent)	120,292	....
Surplus	$430,281	$334,476

The balance sheet as of Dec. 31, 1905, compares with that of the same date in the preceding year as follows:

Assets:	1905	1904
Construction plant	$18,883,934	$18,492,852
Supplies	213,717	159,991
Cash and debts received	254,602	209,073
Prepaid accounts	5,736	5,927
Treasury bonds	319,000	189,000
Stocks and bonds	206,623	55,500
Job and work orders	36,895	12,465
Sinking fund bonds	68,000	66,000
Sinking fund premium	4,060	3,900
Sinking fund trustee	9,627	883
Total	$20,002,196	$19,195,594
Liabilities—		
Capital stock, preferred	$2,400,000	$2,400,000
Capital stock, common	6,014,600	6,014,600
Mortgage bonds	10,358,000	10,089,000
Accounts payable	216,098	141,512
Interest payable	4,791	4,888
Taxes payable	26,549	5,686
Reserve accounts	95,108	86,453
Sinking fund interest	13,377	10,063
Profit and loss	873,671	443,389
Total	$20,002,196	$19,195,594

President Arkwright in his remarks to the stockholders says in part:

"The property is in good condition. In this connection it is to be noted that of the 144 miles operated 105 have been entirely built or rebuilt since 1899.

"The sum of $391,483 was expended for various kinds of new construction during the year; $319,000 consolidated bonds were issued to the company during the year, but are held by the company as treasury assets.

"The Atlanta Northern Railway Company completed its interurban line from Atlanta to Marietta, and its operation commenced on July 17 last. Its entire capital stock is owned and its bonds guaranteed by the Georgia Railway & Electric Company. It owns 15 miles of track. From July 17 to Dec. 31 last its gross earnings amounted to $51,596; operating expenses and taxes were $30,534, leaving net earnings of $21,061.

"There is no special cause for the growth in earnings of the Georgia Railway & Electric Company during the year other than the continued growth and prosperity of the section served by your company. The growth in the railway department did not come from increased mileage, as none was added."

DETROIT, MONROE & TOLEDO TRANSFERRED

On March 1 the sale of the Detroit, Monroe & Toledo Short Line Railway to the Detroit United was consummated, and the property again passed into the control of the Everett-Moore syndicate, which owned it previous to their embarrassment. The old directors of the Short Line have resigned and the following have been elected: H. A. Everett, E. W. Moore, J. C. Hutchins, George H. Russell, Edwin Fullerton, Allen F. Edwards, John Brampron and A. E. Peters. The new board elected the following officers: J. C. Hutchins, president; F. W. Brooks, vice-president; George H. Russell, treasurer; A. E. Peters, secretary. Mr. Hutchins announces that there will be no change in the operating staff, and that W. B. Tarkinton will continue as general superintendent in direct charge of the property. The road is one of the finest pieces of electric railway construction in the country. More than half of it is double track, and limited cars make the 60 miles from center to center in 2 hours. It is stated that as soon as arrangements can be made through cars will be operated from Cleveland to Detroit in connection with the Lake Shore Electric, also an Everett-Moore property.

REPORT OF HAVANA ELECTRIC RAILWAY

The report of the Havana Electric Railway for the year ended Dec. 31, 1905, has been made public. It shows an increase in gross receipts of $272,246 and an increase in surplus of $370,921. The detail figures follow:

	1905	1904
Gross receipts	$1,542,870	$1,270,624
Operating expenses and taxes	776,052	724,746
Net earnings	$766,818	$545,878
Interest on funded debt	395,897	408,270
Surplus	$370,921	$137,608
Previous surplus	138,153	545
P. & L surplus	$509,074	$138,153

President Hanson, of the company, in his report to shareholders, says: "Having regard to the fact that the profits for the year, after paying all fixed charges, amount to $370,000, and that a glance at the statement will show you that the company has absolutely no liabilities, except practically those of the current month, while the reserve fund now amounts to about $500,000, the directors feel that the shareholders may reasonably hope for a dividend on the preferred shares in the near future. The outlook, so far as the directors can see, is just as favorable for expansion for the current year as it was last year and the year before."

During the past year the company has turned out from its own shops in Havana thirty new passenger cars at a cost of less than $90,000. This amount being much less than the same equipment would cost purchased in the United States justifies the action of the board in providing the necessary shops and equipment for this purpose. An arrangement has been reached with the Havana Central Railroad Company by which certain rights held by this company for the construction of lines in the province of Havana, were sold to the railroad company, and these lines are now being constructed by that company. An agreement was also reached with the Cuban & Pan-American Express Company by which the Havana Electric agreed on satisfactory terms to transport over its lines the express freight of the express company.

At the stockholders' meeting of the Havana Electric Company, held in Jersey City, the proposed issue of $300,000 of bonds was ratified and directors were re-elected. The reason for the issue of $300,000 of bonds is to make proposed extensions of the system.

DATE SET FOR SALE OF NATIONAL ELECTRIC PLANT

A formal order has been entered by Referee Maxwell, at Milwaukee, directing the sale of the plant, real estate, patent rights and good will of the National Electric Company, on March 26, in the referee's court, at Milwaukee. The meeting of the creditors was harmonious, and no objection was entered in the proceedings. N. A. Christensen, the former owner of the plant, who has already submitted a bid for the purchase of the bankrupt electric company, was present with his attorney, E. H. Bottum. The resolution provides for the sale of the assets of the National Electric Company at public auction, to the "highest bidder for cash"; the trustee to require a deposit of $25,000 as an earnest of good faith. The entire assets are to be offered free of all encumbrances, and the purchaser must assume all of the unfinished contracts in force at time of sale. There is no doubt that the offer of the Standard Trust Company, of New York, will be accepted, as up to date it is the most advantageous bid made, and will realize to all creditors 50 per cent on their claims. Attorney Francis G. Bloodgood stated in court that claims aggregating over $1,000,000 which his firm represents have already accepted the New York Trust Company's proposition. Mr. Bloodgood was asked if the Westinghouse Company, of Pittsburg, which at the time of the bankruptcy proceedings was negotiating for the purchase of the plant, was the client for which the Standard Trust Company was acting, but he refused to commit himself on the question. The report of the appraisers of the company inventories the property as worth $3,033,517.46, including supplies, $411,619; machinery, $205,877; tools, $37,630; equipment, $42,459; the shop in Paris, $10,000; real estate, $69,000; buildings, main property, $196,448; south side shop, $3,000; sprinkler system, $32,503. The First National Bank filed one of the largest claims of indebtedness against the bankrupt electric company March 12. The amount is for $236,621, with interest at 6 per cent, and alleges money loaned, between Aug. 23, 1901, and April 15, 1905. Charles A. Brown, an attorney in Chicago, also filed a claim against the National Electric Company for $6,743.

NEW PUBLICATIONS

The Business of Contracting. By Ernest McCullough. Technical Book Agency, Chicago, Ill. Paper, 45 pages. Price 50 cents.

The field covered by this book is well denoted by its title, as it is a compact statement of the various factors that must be noted to carry out contracting successfully. The author treats of the organization of the staff and the characteristics that should be possessed by the men holding the positions of manager, superintendent and foreman; methods of bidding and figuring costs; following the spirit or letter of the engineers' specifications; field and office practice, and, in fact, neglects nothing which his own experience has found worth knowing. The booklet should also be of value to consulting engineers and others who have dealings with contractors, that they may have a clearer knowledge of the contractor's point of view.

Motive Power and Gearing for Electrical Machinery. By E. Tremlett Carter. Second Edition; revised in part by G. Thomas-Davies. New York: D. Van Nostrand Company; London: The Electrician Printing & Publishing Company; 672 pages; Illustrated. Price, $5.

This is a second edition of the excellent book on power-station equipment by the late Mr. Carter. Mr. Thomas-Davies' additions are principally in bringing it up to date in the departments of gas engine and producer design, steam turbines and superheated steam. The book not only discusses the theory but also the design and construction of the apparatus used in electric power sations.

Report of the Ninth Annual Convention of the Street Railway Accountants' Association of America. Published by the Secretary of the Association, Birmingham, Ala. 292 pages.

The report of the Philadelphia convention of the Accountants' Association is at hand, and in addition to the proceedings contains the constitution and by-laws of the new association, list of attendants and of members, summary index of previous reports, the Standard Classification of Accounts and Standard Form of Report. The two latter are brought up to date, and are provided with complete indices. There is also an excellent portrait of Ex-President Ross. The Philadelphia convention was especially instructive, and the papers and discussion will bear reading.

STREET RAILWAY PATENTS

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

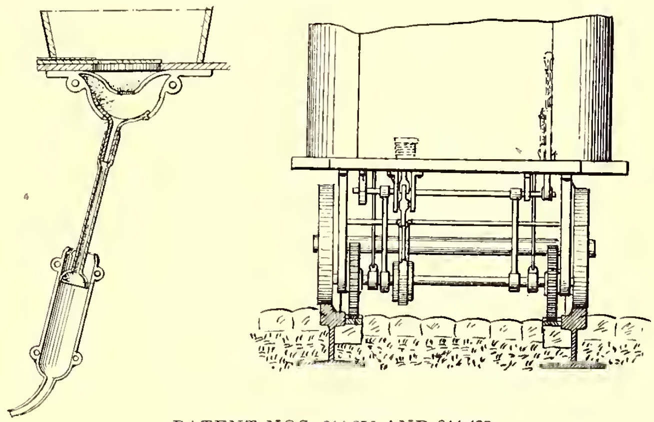
UNITED STATES PATENTS ISSUED MARCH 6, 1906

814,075. Trolley Catcher; Simeon F. Pierce, St. Paul, Minn. App. filed June 5, 1905. A fluid pressure cylinder attached to the trolley has a piston valve, which moves to admit air to the cylinder in case the wheels leaves the wire and flies upward. The admission of air serves to depress the piston and retrieve the pole.

814,081. Guard Rail for Cars; Michael W. Rogers, Lexington, Ky. App. filed July 14, 1905. An open car guard rail equal in length to the length of the carbody, and capable of being shifted endwise to alternately close the platform passages.

814,245. Railway and Railway Car; Philip K. Stern, New York, N. Y. App. filed April 8, 1905. The passenger compartments are suspended at each side. The ends of the car slope downward to the rails and are provided with track rails running longitudinally over them so that meeting cars may pass one over the other.

814,256. Track-Sanding Apparatus; Brutus D. Willits, Des Moines, Ia. App. filed May 25, 1905. A flexible sand delivery pipe is so connected to the car truck as to present its nozzle directly toward the rail at all times.



PATENT NOS. 814,256 AND 814,422

814,278. Switch-Operating Device; Oliver J. Du Vernay, Leominster, Mass. App. filed March 20, 1905. A flat plate mounted on the lower end of a suitable standard and having a rib on its under side set at an angle to the rails.

814,293. Mechanism for Transmitting Power from Car Axles; Delbert F. Johnson, Chicago, Ill. App. filed July 7, 1905. A fan and casing therefor for ventilation purposes are incorporated in the power transmitting device, among other details.

814,322. Reversing Switch for Electrical Circuits; Thomas S. Perkins, Wilkinsburg, Pa. App. filed June 6, 1904. A motor-reversing switch, operable by a pilot circuit, has two opposed solenoids acting on an intermediate plunger in the manner of a donkey pump. The plunger has various metallic rings, which establish the power circuits through suitable contacting fingers.

815,364. Lamp Regulator; Alphonsus L. Drum, Lake Forest, Ill. App. filed March 28, 1905. The lamps of a train are grouped in a single-series multiple circuit receiving current from the trolley. A solenoid automatically cuts out some of the lamps in case the voltage falls below a predetermined value.

814,371. Means for Oiling Tracks and Applying the Air Brakes for Stopping Railway Trains; Elijah S. Gunn and Harry R. Romberger, Sinona, Miss. App. filed Dec. 26, 1905. Means for automatically operating the air brakes and applying oil to the rails in advance of the locomotive in case the engineer disregards a danger signal.

814,376. Railway Signaling Device; Samuel C. Harvey, Bowling Green, Ohio. App. filed April 12, 1905. Details.

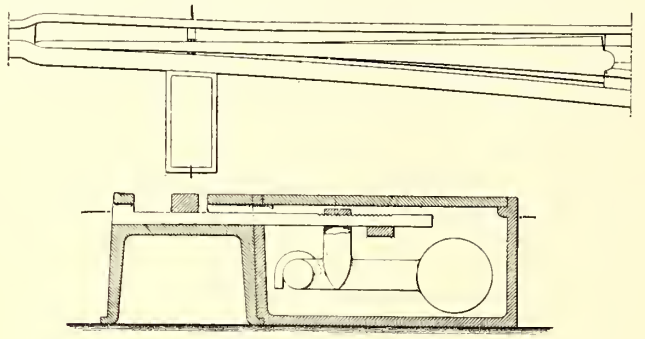
814,401. Rail: Carman M. Simpson, Millvale, Pa. App. filed Nov. 24, 1905. A base portion provided with two vertical web-flanges, and a tread portion having a flange adapted to seat between the web-flanges and be bolted therein. The base and tread portions alternate, thus providing a substantially continuous rail.

814,409. Railway Car Truck; George C. Stewart, Marengo, Ind. App. filed Oct. 27, 1905. A spring-supported bolster beam carried transversely of the car-truck frame, a guide-box laterally inclosing the bolster, an equalizing bar pivoted centrally on the beam and secured to the carbody, and oppositely arranged flexible connections between the equalizing bar and the car-truck frame at each end of the bar.

814,422. Brake; Hugh Beatty, Pittsburg, Pa. App. filed Jan. 9, 1906. An emergency brake consisting of cog wheels adapted to be depressed to engage racks mounted in the roadbed.

814,455. Car Seat; John B. Kilburn, Philadelphia, Pa. App. filed June 18, 1904. Details of construction of a "walk-over" car seat.

814,489. Brake Hanger; Walter O. Webster, Philadelphia, Pa. App. filed June 13, 1905. A bracket having a curved pocket and having a curved portion directly under the pocket, a hanger-rod having an enlarged portion bearing against the under side of the bracket, and having a stem extending through a slot in the



PATENT NO. 814,504

bracket, a shoe curved to fit the pocket and having an opening through which the stem of the rod passes, and means for adjusting the shoe on the stem so as to make a neat fit between the shoe and the pocket and the enlarged portion of the rod and the bracket.

814,504. Railway Switch; Victor Angerer, Ridley Park, Pa. App. filed June 8, 1905. Means for preventing accidental displacement of the switch, consisting of a bar attached at one end to the switch point and extending into a box, where it has a notched under surface. Also mounted in the box is a centrally pivoted lever weighed at one end, its other end having teeth for engagement with the notches on the bar.

814,505. Railway Switch; Victor Angerer, Ridley Park, Pa. App. filed June 8, 1905. One end of a bar is attached to the switch point, the other end extending into a casing at the trackside. A spring-pressed dog in the casing engages notches in the bar to hold the switch in either of its positions.

814,514. Car Seat; Edward G. Budd, Philadelphia, Pa. App. filed May 19, 1905. Details of construction of a "walk-over" car seat.

814,537. Safety Device for Railway Switch and Signal Apparatus; Lawrence Griffith, Yonkers, N. Y. App. filed Sept. 20, 1905. The switches are operated by electric means supplied from a power circuit, and the indicators for the switches are not operated until the power current for the switches ceases.

814,535. Electric Signal Apparatus; Lawrence Griffith, Yonkers, N. Y. App. filed Oct. 28, 1904. Modifications of the above.

814,645. Railway Car Wheel Skid; William H. Fletcher, White River, Can. App. filed April 4, 1905. A flanged shoe to be placed between the rail and a defective car wheel.

814,658. Safety Device for Railway Switch and Signal Apparatus; Lawrence Griffith, Yonkers, N. Y. App. filed Nov. 5, 1904. The signals are operated by compressed air, and means is provided whereby the indicators are not operated until the air pressure is removed.

PERSONAL MENTION

MR. JACOB RICH, prominently identified with street railroading in San Jose, Cal., in the pioneer days, is dead.

MR. W. R. COLLIER, who has been contract agent for the Georgia Railway & Electric Company, of Atlanta, Ga., has been appointed manager for the Electrical Manufacturing & Equipment Company, of Atlanta.

MR. WILLIAM C. DOUBLEDAY, for fifteen years secretary of the North Hudson County Railway Company, is dead. Mr. Doubleday resigned from the company at the time of its absorption by the Public Service Corporation of New Jersey.

MR. ROBERT BONNER, of Cincinnati, has been appointed auditor of the five roads recently acquired by the Widener-Elkins syndicate, heretofore known as the Appleyard lines. Mr. Bonner will have his headquarters in the Traction Building, Cincinnati, from which place the properties will be managed.

MR. ARTHUR W. FIELD, who for a long time has been the agent in Boston for the Peckham Manufacturing Company, has resigned from that position and has been appointed sales agent, in Boston, for the Duquesne Steel Foundry Company, of Pittsburg, which manufactures the Fowler rolled steel car wheel.

MR. JOHN H. HUMPE has been appointed general manager of the Lincoln Traction Company, of Lincoln, Neb., to succeed Mr. Charles H. Cox, whose resignation was announced in the STREET RAILWAY JOURNAL for March 10. Mr. Humpe formerly was general manager of the company.

MR. C. H. BISHOP, superintendent of the Chambersburg & Gettysburg Electric Railway Company, of Chambersburg, Pa., has been appointed superintendent of the Valley Traction Company, with headquarters at Lemoyne, vice Mr. George H. Bartle, resigned. For the present the duties of superintendent of the Chambersburg & Gettysburg Company will be performed by Mr. D. B. Fritz, electrician.

MR. SAMUEL S. HOFF, general superintendent of the Wilmington City Railway Company, of Wilmington, Del., was surprised at his home a few evenings ago by about twenty-five of the officials of the various lines under him, in honor of his fifty-fifth birthday anniversary. Mr. C. D. Mills, superintendent of the Chester Traction Company, in behalf of the officials present, presented Mr. Hoff with a massive Davenport sofa of quartered oak, with embossed velvet upholstering.

MR. WESLEY WENTWORTH has been appointed general manager of the Houston Electric Company, of Houston, Tex. Mr. Wentworth comes from Dallas, where for the last nine months he has been superintendent of the Dallas Consolidated Street Railway Company. Mr. Edward C. Reichardt, cashier of the Houston Electric Company, has been appointed assistant to the treasurer of the Fort Worth Street Railway and of the Fort Worth-Dallas Interurban Railway.

MR. CHARLES H. SMITH, superintendent of the Troy division of the United Traction Company, of Albany, has been promoted to be general superintendent of all the operating lines of the company. Mr. Smith has worked his way through all the grades of the service to his present position, and is now in his thirty-sixth year of continuous connection with street railways in Albany and vicinity, having closed his thirty-fifth year on Dec. 1 last. He began as a boy, at the old horse-car barns in Cohoes, and rose to foreman, next to assistant superintendent of the Cohoes line, then to superintendent of the Troy and Lansingburgh line, subsequently to the superintendency of the Troy City Railway, and for six years he has been superintendent of the Troy division of the United Traction system.

MR. C. NESBITT DUFFY, recently secretary and auditor of the Chicago City Railway Company, was elected on March 8 treasurer of the General Paper Company, with offices in the Merchants' Loan & Trust Building, Chicago. He will immediately assume the duties of this new office. Mr. Duffy was a charter member of the Street Railway Accountants' Association and has always taken a prominent part in the work of that association. He was president of that association in 1899-1900, and as chairman of the committee on standard classification and accounts has been largely instrumental in the establishment and general adoption of the form which has now come into such general use. He is also chairman of the standing committee on international form of report, and presented the report from this committee at the last convention. His many friends look upon his withdrawal from street railway work with regret, but wish him every success in his new line of activity.

MR. ROBERT T. IVORY, formerly general superintendent of the Youngstown, Park & Falls Railway Company, of Youngstown, died at his home in Pittsburg a few days ago. He had been in poor health for some time, and retired from the above mentioned position several months ago. Mr. Ivory was forty years of age, and he spent nearly half his life in the traction business, building and operating a number of roads. From 1886 to 1892 he was with A. E. Townsend, of Townsend & Brown, New York and Boston, and superintended the construction of the following roads: Pittsburg, Knoxville & St. Clairsville, Pittsburg & South Side, Pittsburg & McKees Rocks, Second Avenue line, Pittsburg; Pittsburg & Birmingham, Penn Avenue, and several other lines about Pittsburg. Later he superintended the construction of lines in Uniontown, Braddock, McKeesport, Washington, New Castle, Pa., Wheeling, W. Va., and Montgomery, Ala. After leaving Townsend & Brown, he became superintendent of construction for William Wharton & Company, of Philadelphia. In 1897 he went with Booth & Flynn, of Pittsburg, and was placed in charge of the Youngstown property.

Street Railway Journal

Vol. XXVII. NEW YORK, SATURDAY, MARCH 24, 1906. No. 12.

Published Every Saturday by the

McGraw Publishing Company

Main Office:

NEW YORK, Engineering Building, 114 Liberty Street.

Branch Offices:

Chicago: Monadnock Block.

Philadelphia: Real Estate Trust Building.

Cleveland: Cuyahoga Building.

London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York"; "Stryjourn, London"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada, Mexico and the Canal Zone.

Street Railway Journal (52 issues)....................$3.00 per annum

Single copies .... 10 cents

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August & November) $4.00 per annum

Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy)....................$6.50 per annum

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues), postage prepaid.................. $6.00

25 shillings. 25 marks. 31 francs.

Single copies ....20 cents

Remittances for foreign subscriptions may be made through our European office.

NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the Street Railway Journal.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires.

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal, 8000 copies are printed. Total circulation for 1906 to date, 98,300 copies, an average of 8192 copies per week.

Washing and Bathing Facilities at the Car House

The exact relation between cleanliness and godliness has never been reduced to accurate definition, but the old proverb about their association may be accepted as being true at least to the extent that, all other things being equal, a clean man is a better man physically, mentally and morally than one who is not clean. From this premise it is but a step in logic to say that the employer who provides for his employees conveniences for washing and bathing and encourages them to make use of these facilities will have a better class of men than one who does not. This is gospel truth when applied to the electric railway industry, and in the discussions about training, handling and disciplining employees there should be some word about giving them facilities for keeping clean.

In this connection it is a pleasure to record a decided tendency toward recognizing the importance of providing washing conveniences, and in most of the designs for new car houses and shops that have come under our observation recently, ample arrangements are made for washstands and baths, and in some of them these provisions are very elaborate. This is all in the right direction, but the point has been raised as to how the companies who are operating with old and antiquated buildings can give their employees the same conveniences as are enjoyed by the men who happen to be attached to the more modern houses. In a recent conversation this question was put to a prominent general manager, and he replied that he was confronted with this problem. His company thoroughly believed in providing bathing facilities for the men but does not feel justified in going to the expense of installing elaborate bowls and baths in the older buildings, because it expects to build new houses and shops within the next year or two. We are of the opinion that in many cases of this kind the mistake is made in assuming that the facilities must be very elaborate in order to accomplish the purpose. While it may be desirable to install expensive bowls and porcelain tubs with marble floors and partitions in new buildings, it is undoubtedly not wise to follow this plan in older buildings that are soon to be discarded. But a small investment in washing facilities will be justified even at the older houses. In this connection the baths installed by the Galveston Electric Company and described elsewhere in this issue will be suggestive. In this case the end desired was secured by building several shower baths from sheets of galvanized iron, at an outlay of a few dollars. These showers have been found to serve the purpose, although not quite as elaborate as some of the arrangements in the newer buildings.

Along this line a word is in order about keeping washroom and toilets clean and orderly. Unfortunately in every group of men there will always be a very small minority who do not appreciate any effort that is made for their own good and have no inclination to co-operate in such improvements. This small minority will oftentimes abuse these privileges, and if not restrained will succeed in keeping the toilets and baths in such condition as to discourage the majority from making use of them. The use and care of these conveniences should be made as important a part of the discipline of the road as any other feature and should be covered in the rules and regulations. The management should also co-operate to the extent of assigning to a janitor or other employee the duty of cleaning out the toilet and bath rooms at least once a day, and he should be held strictly to account for their condition at all times. It is essential to keep the rooms scrupulously clean if any attempt is to be made to induce the men to keep themselves clean, and the large majority of right-minded employees should not be made to suffer because of the carelessness or the untidiness of the few.

Gasoline and Gasoline-Electric Cars

This type of vehicle is now coming into sufficient use to make it worthy of some further consideration. There are to be found many short lines, generally branches of steam roads, for which it seems hardly profitable to maintain a locomotive equipment, and which, owing to their light traffic, the owners hardly venture to equip for a trolley system. It is in just such cases that the motor car in one form or another has its most promising field of usefulness. We have recently described several such cars, and more are coming into notice. The economic situation, however, is as yet indeterminate. To make good its promise a motor car must be low in first cost, economical to run and cheap to keep in repair. Unless it meets all these conditions with reasonable success, it will fail as a practical means of transportation. As regards the first condition, the simple gasoline car obviously has a considerable advantage over any of the more complicated forms. We doubt whether any manufacturer would care, with a gasoline-electric car, to try to meet the price of the simpler form for an equipment, giving the same wheel torque at the same normal speed on a track with moderate grades. On the second count, nobody contends that one can deliver power as cheaply from a small gasoline engine as from a big power station, but in the case in hand the big power station cannot be considered. Given a road five or ten miles long with light traffic requiring only infrequent service to meet all requirements, and the power station is necessarily small and of low efficiency. It presents the most possible economic aspect of the electric drive unless power can be obtained cheaply from a station already operating a day load. In such case, particularly with a. c. transmission, one can do pretty well.

Barring this, power for such a road comes high, and it would not be in the least surprising to find the gasoline motor able to give a good account of itself. The gasoline-electric car, of course, suffers from the losses in dynamo, motors and battery, if one is used, gaining something, however, in uniformity of load upon the engine. A straight gasoline equipment has the inherent disadvantage of more or less complicated change gearing, which loses power and increases the upkeep. Right here we are going to put in a plea for information. The automobile industry has brought out a vast variety of speed-changing gears, comprising almost every possible combination of gearing and chain drives. Does anyone yet know even the approximate losses actually found in such transmissions? Of course, one can make an educated guess at the facts, but how near can one expect to come to the conditions existing after continued use, that is, the average conditions? Undoubtedly there is for any combination a certain engine speed which will give the best economic result. The nearer one can come to this speed the better for the prime mover. Now, assuming this speed of engine shaft, what is the best that can be done with the gearing for various wheel speeds? Automobile builders have certain shop tests along this line, but they cannot fairly represent average working conditions and leave one in doubt whether to expect an average efficiency of 80 per cent or of 60 per cent in the drive to the wheels. Here is a good chance for research in some of the technical schools, to get hold in winter of such cars as can be secured, strip each to the chassis, and then study the efficiency of the drive in its various combinations.

Whatever the results might be, it should be stated for the encouragement of those who wish to use motor cars on rails, that in such use better work can be expected than in case of automobiles. For the drive can be made, not only simpler on account of transmitting power to the driving wheels as a pair, but more efficient on account of the tendency toward a fairly regular running speed. The main transmission could therefore be made fairly simple and efficient without the extreme flexibility needed in an automobile. For a guess the gain in efficiency over a typical automobile drive could be made something like 10 per cent. This would imply, too, a gain in cost of maintenance and in reliability. The motor railway car also gains very greatly in the substitution of steel for rubber tires. The tires are a very large item in automobile upkeep, and are the most common cause of break-downs. Altogether, therefore, the motor railway car should be able to do considerably better in cost of power and of maintenance than an ordinary automobile. As to convenience, a common trolley car undoubtedly has the better of a gasoline car. The vital question, however, is whether the latter can in point of convenience meet the requirements of such roads as are here considered. Assuming a line with infrequent traffic and moderate grades, we see no reason why the gasoline car should not give good service. The smaller the traffic and the more modest the speed the better relatively would it do. Some recent cars are reputed to be capable of working well on kerosene as a fuel. Kerosene has not been yet satisfactory in automobile engines, but with the larger permissible weights and greater space found in a railway car this condition may be greatly improved. It certainly would be most desirable to use kerosene on account of its lower cost, and if Congress frees alcohol for industrial purposes, this may also become available.

The danger in such equipment is that it may be pushed out of its economical sphere of usefulness. As traffic becomes heavier and heavier a point will be reached where the power cost and maintenance of gasoline or gasoline-electric cars will cease to be economical as compared with a trolley system. Of course, good and quick service increases traffic, and it might easily happen that a branch line might struggle along at small profit for years, when if converted to a well equipped trolley system it would quickly build up a paying business. On this one has to take chances. The lower the original and maintenance cost of a motor railway car the better its chance on lightly used lines. That it has a real field hardly admits of doubt, the real question being its extent. We certainly know of some roads now equipped with the trolley or with locomotives where it would give good service, and these are locations where it could well be used to clear the way, as it were, for work on a larger scale. The modern motor car is a vast improvement on the "dummy" of earlier days. In our judgment its most useful field is not only on light lines but on a rather modest scale of speed and power, enabling lines to be built and equipped for light service at a cost lower than can be reached in any other way. For light railways there is a very definite need which might thus be met at minimum expense. It is possible, too, that motor railway cars might now and then be useful where the public objects to overhead wires. At least such cars have an adequate reason for existence and have probably come to stay. Their function is distinctly supplementary, however, and we see no likelihood of their making any considerable change in the present general scheme of transportation.

The New York, New Haven & Hartford Single-Phase System

Mr. Lamme's paper before the New York Railroad Club last week, upon this equipment has been eagerly awaited by the engineering public, and we are glad to be able to present it to our readers in the current issue. We are glad to note, also, that it is not disappointing, but gets at the situation in a very interesting manner. It is now clear that the New York, New Haven & Hartford Railroad has gone about the selection of its system with an eye to the future. It had the advantage of not being hurried into a choice and of profiting by a large amount of recent experience. It had before it the opportunity to use third-rail construction and d. c. apparatus, such as the New York Central is employing. It also had several possibilities in the way of alternating equipment. Had it been disposed to extreme conservatism it could have put in standard d. c. apparatus, but its problem was, viewed in the large, of a different sort from mere terminal work. To make the most of a change in motive power it must plan for a wide extent of lines, covering the whole eastern suburban service for the metropolis, and hence was impelled to take a step which some may regard still as too radical, but which certainly is in the right direction.

As Mr. Lamme has pointed out, there are several ways of utilizing high voltage on the trolley wires. Polyphase motors are looked at askance in this country as demanding at least two trolley wires and as presenting considerable difficulties in speed control. There remain two other alternating motor systems which have been seriously considered—the Leonard system with its transformation on the locomotive, and the series-commutating scheme in its various modifications. The former system, which possesses some very valuable properties, seemed to run into rather formidable weights, and when worked out with a single-phase induction motor in the motor generator set, involved some difficulties. We are inclined to think, however, that the last word has by no means been said on the transformation of single-phase to direct-current. However this may be, the commutating single-phase system was chosen and the resulting locomotive is now in evidence. At first glance it certainly presents the characteristics of a very business-like machine. With four pairs of 62-in. drivers, each coupled to a 250-hp motor carried on a quill over the axle, it would appear to have a very direct and powerful drive, and the truck structure has the appearance of great strength and simplicity. Of course, the main interest centers in the motors themselves. These are connected permanently in pairs, each pair taking 450 volts a. c. or 550 volts to 600 volts d. c. Owing to the pairing the motors can keep down to the 225 r. p. m. rated speed desired. Permanent pairing without connecting rods seems to involve some extra care in securing power division of the load. As the trial locomotive has already been run 2000 miles, there should, however, have been plenty of opportunity for studying this phase of the matter.

The motor suspension is of a kind which has been already used and hence presents no untried conditions. An interesting feature of the motors is the provision for artificial ventilaation, a device which we have more than once urged in these columns as a feasible and useful means of gaining in output. In a case like this, where the motors must be of large output and wound for low speed, forced ventilation is particularly useful. The speed control is secured on the a. c. connection by transformer taps, giving ample chance for smooth regulation with very little use of intermediate resistances. On the d. c. connection, however, some special features have been introduced, particularly speed variation by shunting the field, after the plan once used but laid aside after the development of the series-parallel control. Now again it proves useful in securing intermediate speeds between the series and multiple connections. This device has one very important bearing in the present case. The one weak point most feared in large series commutating motors has been the danger of serious sparking. The fact that these motors will do satisfactory work on d. c. with the fields shunted even below half normal strength, speaks volumes for the quality of the commutation which has been secured in the present design. The control system is electro-pneumatic with complete provision for a. c. and d. c. control and for multiple-unit operation when desired. The need of both a. c. and d. c. operation, and for taking current both from overhead conductors and third rail, together with the addition of a small steam heating outfit for heating the cars, adds an amount of complication to this initial equipment that should never be found in another.

In the discussion, of which an abstract only is published, Mr. Wilgus brought out very clearly some of the objections to overhead construction and emphasized the practical necessity of throwing every safeguard possible around certainty of operation. Mr. Sprague presented arguments in favor of higher voltage d. c. motors and Mr. Townley outlined some of the reasons which lead the New Haven railroad to adopt the a. c. system. We sincerely trust that Mr. Sprague's advocacy of increasing d. c. potential will be followed by practical trials, as in that case a much wider choice in electrification would be open to railway managers than at present. This, however, must be borne in mind. At the time when the New Haven decision had to be made, and the same is true even at present, the choice practically lay between 600 d. c. and high-voltage a. c., either single-phase or three-phase. To fulfill these conditions an a. c. locomotive has been designed apparently adequate to do the work expected of it, taking current from a 11,000-volt trolley wire with the simplest sort of a feeding system, and enabling a single power house to serve directly 40 or 50 miles of line. The final test, that of practical operation of the line, has not yet been applied. It will ere long, and we trust successfully. It is the first flight away from the dead level of conservatism that has estopped progress in the larger railway work for the past decade, and success will have a far larger significance than in the case of any other recent installation.

The New Haven electrification promises to effect a revolution in transportation methods as well as along electrical engineering lines. As is well known, the New Haven company controls a large number of the trolley systems in the cities traversed by its main line, and for this reason offers possibilities in the direction of a co-operative service between the two systems, which in all railway work heretofore have been conducted along entirely separate lines. An outline of the plans of the company in this direction was given by Mr. Townley but they were discussed at greater length by President Mellen, at Hartford, this week, in an address published in abstract elsewhere in this issue. According to President Mellen, when the new system is in operation, the suburban passenger can take his train at his station, have a fast run to the city over the trunk line and then be conveyed in the same car by the trolley line into the heart of the business district.

RECENT IMPROVEMENTS IN BIRMINGHAM

The following is an outline of the operations and properties of the Birmingham Railway, Light & Power Company. In later articles will be presented studies of the company's important operating features, shops and shop practices, and details of the power generation and supply.

The Birmingham Railway, Light & Power Company, of Birmingham, Ala., is a consolidation of twelve original street railway, gas, electric light and power companies owning and operating the entire street railway, gas, electric light, steam heating and power business in the Birmingham district—a section of the country in the richest portion of the State of Alabama, extending along the Jones Valley for a distance of 30 miles from Red Mountain on the southeast to the Warrior River on the northwest. The city of Birmingham lies near the geographical center of this district, and, as will be understood by reference to the accompanying map of the district, includes some ten independent municipalities, ranging from small villages to important cities.

As germane to a study of the company's property and operations, it may be stated that the population of the territory included within the scope of its activities is about 133,000, and this population is increasing with great rapidity. Since 1900, the number of people in the city of Birmingham alone has increased over 43 per cent, bank deposits have increased over 114 per cent and postal receipts over 112 per cent, and during this period upwards of 12,000 new houses were erected in the city and suburbs. These statistics are the more remarkable when it is considered that the city has been in existence only since 1871.

This unexampled development is due primarily to the fact that practically the entire Birmingham district is underlaid with enormous deposits of coal, iron and limestone, and it is stated that nowhere else in the world are these three essential elements, which enter into the production of iron, found in such close proximity in such quantities. Because of the importance of its coal, iron and steel interests, the city has received the title of "The Pittsburg of the South." Aside from its mineral and allied industries, the Birmingham district is the seat of nearly 300 mills, factories, shops and plants for the manufacture of cotton-seed oil and by-products, fertilizers, bricks, sewer tile, cement and numerous other products. Seven important trunk-line railroads enter the city, and two others are acquiring terminals.

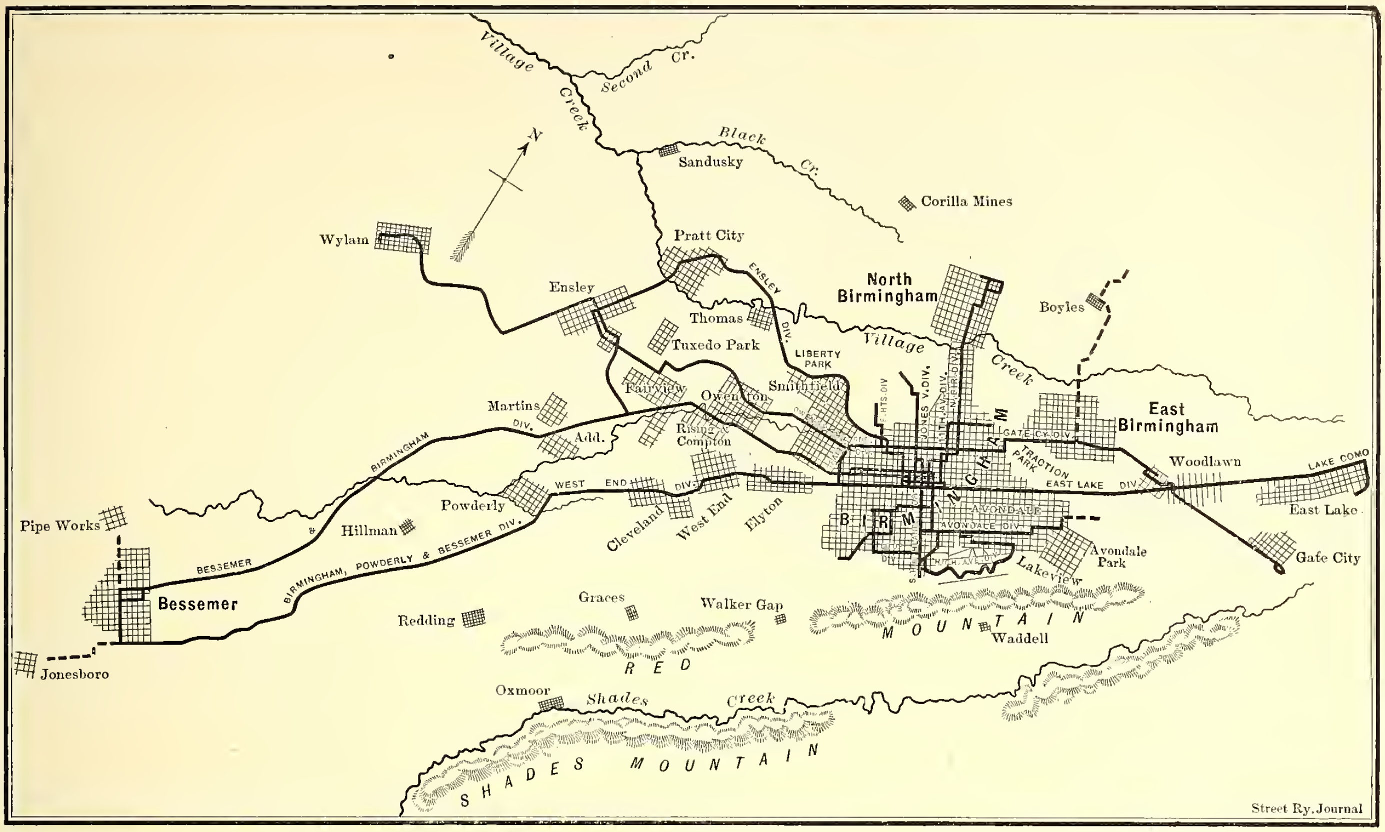
The franchises of the company covering the gas, electric light and nearly all of the street railway business in the city of Birmingham, are unlimited in time. A majority of the franchises under which the company operates its railway lines outside of Birmingham, are either unlimited in time or its tracks are located on private right of way. The franchises for the generation and sale of electricity and gas outside of Birmingham, are unlimited in time or extend for 29 or 30 years. The company is fortunate in that all its franchises are free from burdensome restrictions.

TYPICAL BUSINESS STREET, BIRMINGHAM, ALA.

The Birmingham Railway, Light & Power Company was organized in 1901 to take over the independent properties. At about that time, Isidore Newman & Sons, of New Orleans and New York, became financially interested in the enterprise, and elaborate plans for improvements and extensions, involving the expenditure of upwards of three millions of dollars, were promulgated. The execution of these plans has been in the hands of Ford, Bacon & Davis.

As an indication of the elaborate scale upon which the betterment work has been planned in all the departments, a few of the single items from last year's budget may be mentioned. In the track department, in addition to the renewing of 12 miles of track and considerable paving work in the city, block signals were installed on the important single-track interurban lines, and terminal loops were built where needed. In the line department, ten miles of new arc-light holder, extensions to the gas mains, and other important betterments at the gas-producing plant. Considerable work was also accomplished in laying new mains for the supply of steam heating.

The plans for the present year include: The building of

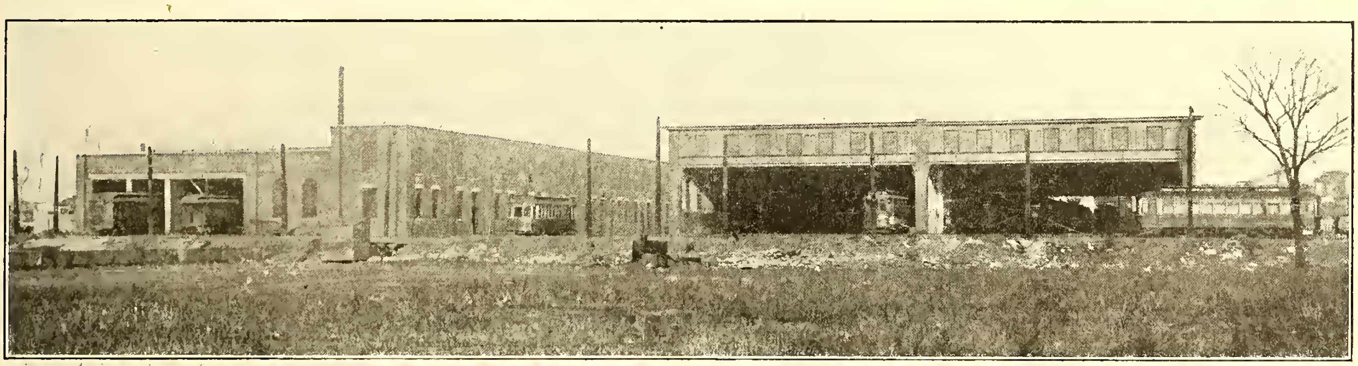


MAP SHOWING LINES OWNED AND TERRITORY SERVED BY THE BIRMINGHAM RAILWAY, LIGHT & POWER COMPANY, OF BIRMINGHAM, ALA.

lines were built, the 2300 volt lighting system in the city and suburbs was reconstructed, and a private telephone system covering the entire district was installed. The rolling stock was increased by 12 cars. The work at the power house, either completed last year or now in progress, includes the extending of engine and boiler room, and the installation of a new 1600-kw direct-connected railway unit, two 3000-

four new railway lines; the building of 36 new cars; and the installation at the power house of one additional 3000-kw turbo-alternator, eight 600-hp boilers and 4000-kw capacity in rotaries.

It is the announced policy of the management to cover the Birmingham district thoroughly and effectually with a modern, quick, clean and reliable electric railway transpor-



REPAIR SHOPS AND CAR HOUSE, BIRMINGHAM RAILWAY & ELECTRIC COMPANY

kw turbo-alternators, six new 600-hp boiler units, the equipping of all boilers with mechanical stokers, and the installation of a novel system of coal conveyors and storage. A new sub-station was established on the Bessemer line, with one 500-kw and two 300-kw rotaries, and three 500-kw rotaries were added at the power house. Improvements in the gas department included the building of a 700,000 cu. ft. gas

tation system. To this end, the company is prepared to build new lines into any quarter of the district upon presentation of logical reasons why the line should be built. In other words, if the people of one of the smaller communities included in the district feel they deserve additional transportation facilities, they have but to place the matter before the management as a business proposition, and if good and logical arguments are brought forth showing the necessity for the line, the importance of the community and the results to accrue, the company will build the line. This policy is being consistently adhered to, and it is working out to the mutual advantage of both the company and the public

TYPICAL CONSTRUCTION ON PAVED STREETS IN BUSINESS DISTRICTS, BIRMINGHAM RAILWAY & ELECTRIC COMPANY

in the district. In accordance with this policy there have lately been built a new line to Ensley, a new line to Idlewild, which is a new residence district to the southwest of Birmingham, and a new line to Wylam.

TRACK AND OVERHEAD CONSTRUCTION

The system comprises about 115 miles measured as single track, of which nearly 63 miles have been reconstructed since 1901. The company is working toward three distinct standards in track construction, to meet the three predominating conditions. These constitute, in paved streets an 89-lb. semi-grooved 9-in. girder rail; in macadamized streets an 80-lb. 7-in T-rail, and in suburban work a 70-lb. A. S. C. E. T-rail. In paved streets, where the paving is laid on a concrete foundation, the concrete course is extended clear across under the roadbed, and forms a foundation for the ties. With the exception of this construction, all track in business, residence and suburban districts is laid on pine ties 6 in. x 8 in. x 8 ft. placed 2 ft. between centers, with a foundation of from 8 in. to 10 in. of furnace slag. The slag is obtained from nearby steel furnaces, and it has been the experience in Birmingham that this material forms an acceptable substitute for gravel as ballast under electric railway tracks. It is porous and therefore drains well, and it possesses the advantage of giving a firmer roadbed as it ages.

Within the last four years, virtually the entire overhead construction on the railway lines has been renewed or reconstructed. In the direction of securing uniformity, span suspension with No. 000 grooved trolley wire supported from creosoted pine poles 14 ins. sq. at the base and tapering to 8 ins. at the top, has been adopted, and all of the overhead center and side-pole bracket construction has been changed to conform to the new standard.

STANDARDS IN ROLLING STOCK

In general, there are on the system four prevailing types of motor cars and two types of trail cars. All of these types have been intentionally retained to suit distinct classes of the service. For the interurban work, the type of rolling-stock consists of a heavy car, 48 ft. over all, seating forty-eight people, and equipped with four GE-57 motors with St. Louis M. C. B. type of trucks, K-14 controllers and Railway Steel Spring Company steel-tired wheels. The second motor type is a lighter double-truck car seating forty people, and equipped with GE-67 motors on Brill 27-G trucks. This type of car is used on suburban lines, and lines on which traffic is heavy. The third type is a single-truck car for city service, designed to seat twenty-eight people, and mounted on Lord Baltimore trucks with two GE-67 motors. The fourth type is a ten-bench open car mounted on Lord Baltimore trucks with two GE-67 motors. This type is for service on city lines in summer, and for handling large excursion crowds. The trailer equipment is divided into two classes, namely, open and closed, and all the trailers are mounted on double trucks.

All of the later cars are of the St. Louis semi-convertible type, in which both of the window sash are designed to drop into a pocket below the sash belt. The standard color for cars is an olive green.

In order to give a better understanding of the conditions under which the cars operate, it may be explained that in the interurban service for which the heaviest type of car is utilized the schedule speed calls for 18 miles per hour, which requires speeds of 35 miles and 40 miles an hour between stops. The next grade of schedules for what may be termed

TYPICAL CONSTRUCTION ON PAVED STREETS IN RESIDENCE DISTRICTS, BIRMINGHAM RAILWAY & ELECTRIC COMPANY

the suburban service, calls for schedule speeds of 10 miles to 13 miles per hour, requiring maximum running speeds of not over 25 miles per hour. On the city schedules, the speed is between 8 miles and 9 miles per hour.

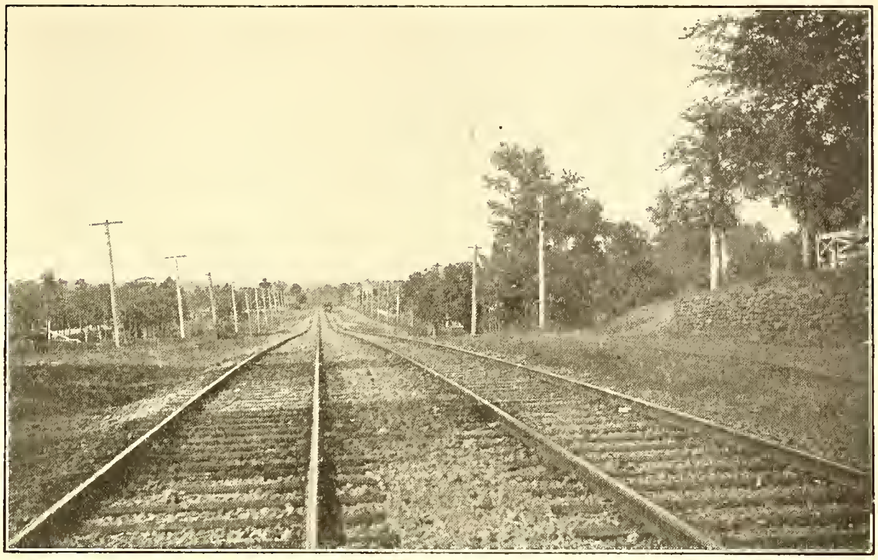
The trailers are utilized for handling the morning and evening loads, and on one or two of the lines an all-day two-car train service is maintained. Operation with trail cars in Birmingham has been satisfactory. There are practically no grades on any part of the system, and any of the double-truck motor cars are able to handle easily a long trail car seating forty people. The experience on this system has been that the running of trail cars does not necessarily increase the accident account, providing the same degree of care is used in operating trailer trains as should be used in running a single car.

CAR HOUSE AND SHOPS

Within the past three years, there have been erected an elaborate car house and repair plant in which have been concentrated the general repair work and storage of all the rolling stock belonging to the company, this work having previously been cared for in several widely scattered plants belonging to the underlying companies. The house and shops embody a number of noteworthy features in design and construction, and these, together with a description of some of the shop practices, will be treated in a separate article.

POWER GENERATION AND DISTRIBUTION

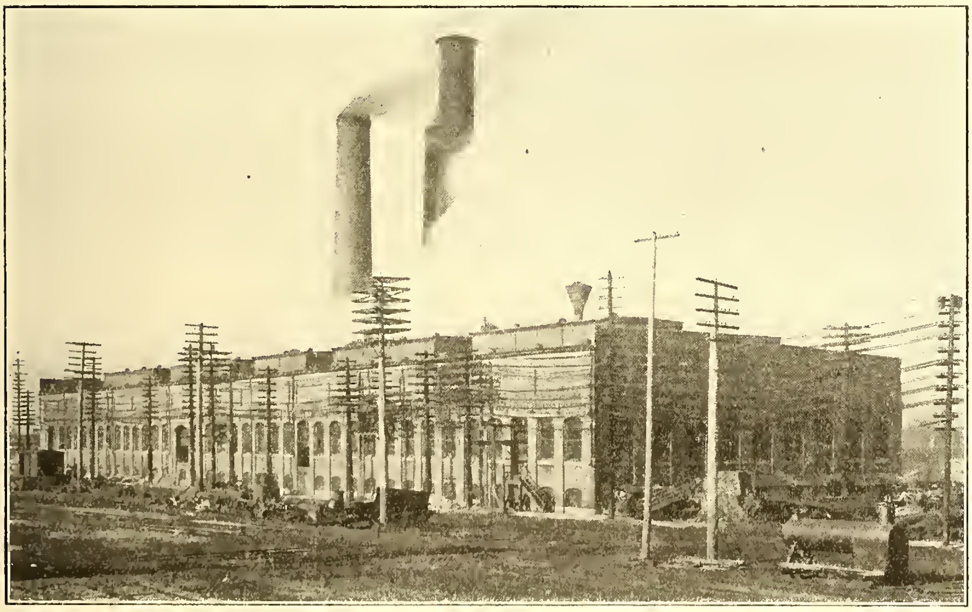
Power for the entire railway, lighting and steam heating business is supplied from one power house, which is being completely remodeled and extended. This work has developed a number of interesting engineering problems, an outline of which, with the solutions that have been applied, will also be made the subjects of a separate article.



TYPICAL CONSTRUCTION ON SUBURBAN LINES, BIRMINGHAM RAILWAY & ELECTRIC COMPANY

THE WEST SHORE ADOPTS THE THIRD-RAIL BETWEEN SYRACUSE AND UTICA

The contracts have just been awarded for the electrification of the West Short Railroad tracks between Syracuse and Utica with the third-rail and direct-current equipment. The cities are 43 miles apart and the miles of track to be equipped are 6 miles of four-track road, 9 miles of three-track road and 28 miles of double-track. Half-hourly electric service will be established between the two cities, consisting of one limited car and one local car each way. The cars will enter the city of Syracuse over the tracks of the Syracuse Rapid Transit Company and Utica over the tracks of the Utica & Mohawk Valley Railway, both of which are controlled by the New York Central Railroad.



EXTERIOR CENTRAL POWER HOUSE, BIRMINGHAM RAILWAY & ELECTRIC COMPANY

Power will be obtained from the Hudson River Water Power Company, which owns the water power development at Spiers Falls, also a steam-power plant at Utica, which is now supplying power to the Utica & Mohawk Valley Railway. The West Shore Railroad Company will have four sub-stations, one at Clark's Mills, one 1½ miles west of Vernon, one 2 miles west of Canestoga, and one at Manlius Center. Power will be delivered by the power company at 60,000 volts to the Clark's Mills sub-station and there distributed and converted by the railroad company. The contract for the sub-station equipment and motors has been awarded to the General Electric Company.

The company will have fifteen cars which will weigh 35 tons equipped and measure 50 ft. over all. They will be of the semi-convertible type and, with the trucks, will be supplied by the J. G. Brill Company. They will be equipped with multiple-unit controllers and automatic air brakes. The New York Central type, under-running third rail with 550 volts at the sub-station, will be used. A block-signal system will be installed . The operation of the electric cars will not interfere with the use of the tracks by the steam trains.

It is expected that the line will be in operation electrically by next October.

The Toledo Railways & Light Company is building an observation car which will be used this summer in sight-seeing tours about the city. It will make regular trips to all points of interest, including Walbridge Park, Toledo State Hospital, Riverside Park, Bay View Park, and the best residence portions of the city. 25 cents will be charged for a round trip.

ALTERNATING-CURRENT ELECTRIC SYSTEMS FOR HEAVY RAILWAY SERVICE*

BY B. G. LAMME

In the problem of heavy electric traction the method of procedure has been very much the same as in other engineering undertakings. The first and most natural means used was that which had shown such remarkable results in light traction work; namely, the direct current system. In the application of this to heavy work, however, the necessities of the problem led to the development of a number of adjuncts, such as the rotary converter or motor generator sub-station for transforming from alternating to direct current, the use of the third rail instead of the overhead trolley on account of difficulty in collecting current, and other features of less importance.

Even with these two vital modifications of the direct current system, it is found, as heavy railway conditions are approached, that one of the weakest links in the system is the voltage drop between the transforming sub-stations and the car or locomotive. This is due primarily to the enormous currents which must be handled with the usual 550 to 650 volt direct current system. Suggestions have been made by prominent engineers that this difficulty should be overcome by increasing the direct-current voltage to 1000 or 1500 volts. However, this solution has not been pushed extensively by the principal manufacturers of electric apparatus, as it is felt that this would be only a partial step in the solution of the problem, like the transforming sub-station and the third rail, and also because there are certain inherent tendencies for trouble in the present 600 volt apparatus, which would be greatly exaggerated at much higher voltages.

While the above development was being carried on, the problem was being considered in other ways. Many engineers objected to the third rail for general use, believing that a live conductor should not be located so near the ground, and that the place for the trolley wire is overhead. Recognizing that high voltage for transmission is necessary, but that, after transformation to direct current, there remains the difficulty of collecting large currents from an overhead wire, it occurred to many that a more suitable solution of the problem could be obtained by supplying the high voltage alternating current directly to the trolley wire and then utilizing it, either directly or indirectly, for propulsion of the car or locomotive.

PORTABLE SUB-STATION SYSTEM

Keeping in view the above trend of direct current development, the most evident of such methods would be to put the rotary converters or motor generator sub-station on the locomotive itself. As the ordinary electric car, even of large size, has practically no place for such a transforming sub-station, this method has not been given serious consideration for such equipment. However, in the case of heavy locomotives it becomes a possible one. In theory it presents some very good points but in practice a considerable objection is found in the size, weight and cost of the sub-station which must be carried by the locomotive. It has been suggested that this sub-station be placed upon a tender equivalent to the present tender of a locomotive, and it has also been proposed that it be placed directly on the locomotive itself. Practically the machinery is limited to a motor-generator set using a single-phase induction motor and direct-current generator.

It may be well to look a little closer into this motor generator transforming set. Considering first, the motor, it may be said that the single-phase induction type motor in its simple form is one of the least effective types of electric machines which we have. It is non-starting, or starts very uneconomically as a distorted polyphase motor. Its power factor, or the ratio of its true power to the apparent power supplied it or the current and volts supplied, is not nearly as good as that of a polyphase motor of the same dimensions. Its output is only about half that of a good polyphase motor built on the same frame. It is, therefore, heavy in proportion to its output. It takes a fairly large current from the line at no load. On account of its poor starting characteristics it would preferably be kept running when the power is shut off from the car motors, and it would, therefore, take considerable current from the line when the locomotive proper is running empty, or is at a standstill for a short time. On account of its magnetic losses and the high speed at which it should be operated, this motor would have appreciable losses, even when running empty, and would, therefore, be drawing energy from the line when the locomotive is coasting or is at a standstill. On a 25-cycle alternating system such a motor could be built with two poles for 1500 r. p. m., or with four poles for 750 r. p. m., the number of poles necessary being a multiple of two. The lower speed machine would be somewhat heavier than the higher speed one, but its losses when running empty would probably be no greater, and could even be less.

Taking up next the direct current generator driven by the above motor, it is seen from the above that it will be run at either 1500 r. p. m., or at 750 r. p. m., corresponding to the above motor speeds as it would preferably be direct driven. The higher speed generator, being the lighter one, would naturally be chosen if this speed is not too high to permit the construction of a first-class generator of the required output. Taking, for instance, an electric locomotive of the above type, and corresponding in capacity to those being built for the New York, New Haven & Hartford Railroad, it would be necessary at times that the generator deliver an output of 1500 kw. or more. Moreover, the load fluctuations would be violent and, therefore, a machine of first-class commutating ability is required. I do not consider that any direct-current machine now built, with the above capacity and with a speed of 1500 r. p. m., is sufficiently good for such service. This therefore implies a generator of questionable characteristics, or the choice of a speed of 750 r. p. m. At this lower speed the size of motor-generator of the above capacity may be too great to be placed on the locomotive itself, although the weight and cost may not be much greater than for the higher speed unit.

For the purpose of comparison, motor-generator units corresponding to the above New Haven locomotive conditions were worked out some time ago. The approximate results are as follows, both for the 1500 r. p. m. and 750 r. p m. outfits.

TABLE SHOWING WEIGHTS, ETC., OF 750-KW MOTOR-GENERATOR SETS

Speed	1500 r. p. m.	750 r. p. m.
Approximate weight	47,000 lbs.	54,000 lbs.
No load losses	65 hp	65 hp
Combined efficiency at 750 kw (1000 hp)	90%	90%
Loss at 750 kw	110 hp	110 hp

The above weights include starting apparatus, exciter, etc., but do not include the massive base plate which is usual with stationary motor-generator sets, as it is assumed that the frame of the locomotive could be made stiff enough to serve for the base. The locomotive structure might require some additional weight, which should also be charged against the portable sub-station outfit.

* Abstract of a paper presented at a meeting of the New York Railroad Club, March 16, 1906.

However, the 1500 r. p. m. unit was not considered a practicable outfit, from the operating standpoint.

Assuming, however, that such a motor-generator set could be used it would permit some very neat features as regards operation of the locomotive. In case it is to be on an alternating-current trolley circuit exclusively, so that the motor-generator set is always used, then the ordinary direct-current control apparatus can be almost entirely eliminated, for the speed of the car motors can be controlled by varying the dirent-current voltage delivered by the motor generator in the manner proposed by Leonard, namely, by varying the field excitation of the generator. In this way any speed within the range of the apparatus may be obtained efficiently, as there are no armature rheostatic losses, and the power supplied is practically in proportion to the load. However, with this method of control a separate exciter is required for the d. c. generator, as a self-exciting machine could not be controlled over a sufficiently wide range.

If, however, the equipment must operate on both alternating and direct current as in the case of New Haven electric locomotives, then a complete complement of d. c. controlling apparatus must also be used as the motor generator will be out of service when the locomotive is on the d. c. trolley.

In addition to the efficiency of speed control, this motor generator scheme possesses another feature which may be of value in special cases. This is its ability to feed energy back into the high voltage a. c. line by suitably exciting and controlling the car motors so that they can be made to operate in a stable manner as generators of power, such power being fed into the motor-generator set and transformed and returned to the line, minus the usual commission, of course. This may be of considerable advantage in letting trains down long grades. In ordinary braking, however, it is a question whether it is worth the complication, as it means that special provision must be made for exciting and regulating the fields of the car motors.

In general, it may be said that the disadvantages of the motor-generator scheme are found in the size, weight and cost of the apparatus and the relatively high continuous losses; also, there are objections, from the mechanical standpoint, to carrying a motor generator operating at high speed. The advantages of this scheme lie in the efficient speed variation, simplified control, and the ability to return energy to the high voltage line, however, at the price of additional complication.

THE POLYPHASE SYSTEM

Another method of solving this railway problem, based on using existing methods and means, is that in which the well-known polyphase alternating motor is used. Various reasons are given for the attitude of those who have discarded or who have not adopted this system. The most obvious of these reasons are as follows:

At least two overhead trolley wires.

The constant-speed characteristics of the induction type motor, preventing efficient speed variation.

General structural features of the induction motor at the usual commercial frequencies.

Taking the first point, it may be said that the use of two overhead wires with a high difference of potential between them is considered very objectionable by many engineers. Those advocating this system have usually talked moderate trolley voltages such as 3300 volts. While higher voltages may be possible there is no question but that the trolley problem becomes increasingly difficult with increased voltage, and the current collecting devices, switches, cross-overs, overhead equipment of the yards, etc., present serious problems.

The constant speed characteristics of the induction type of motor have come in for much criticism when used for railway work. One law of the induction motor is that it requires a given amount of power to develop a given torque or turning effect, regardless of the speed at which it is running. At full speed the power supplied to the motor appears as useful output, with the exception of the losses in the motor itself. At one-half speed the same power applied gives but one-half full output, the remaining power being wasted in heat. At one-tenth speed, nine-tenths the power is wasted. This difficulty is overcome to a certain extent by using two or more motors arranged in the so-called "cascade" or "tandem" connection. However, there is but one speed at which these two motors, connected in tandem, can operate efficiently, and below this speed the power is again wasted. The two motors in tandem act as if a single motor had been geared for lower speed. The result is the same as if one constant speed motor had been used with a high and a low gear, to give two changes in speed. These two speeds correspond to the efficient running conditions. By the addition of a friction clutch for intermediate conditions and the use of gears with two-speed ratios with a single motor, we approximate closely the conditions of operation, as regards economy, that would be obtained with two induction motors arranged to be operated singly and in "tandem."

Normally the induction motor, in comparatively large sizes, closely approximates a constant speed between no load and full load. The variation in speed within these limits will usually be less than 2 per cent. Two such motors rigidly connected to the same load must have the same speeds or they will not divide the load equally. Assuming that the normal speed variation in the motor is 2 per cent and that one pair of car wheels or drivers is 2 per cent smaller than the other, then one motor will tend to run 2 per cent faster than the other at all times. They will, however, automatically adjust for equal speeds by unbalancing their loads. At no load one would tend to take half its rated load as a motor and thus drop 1 per cent below synchronous speed, while the other would tend to raise 1 per cent above synchronous speed, and carry half load as a generator. The resultant would be equal to no load but each motor would be carrying half load. Again, at half the rated load of the two motors, one would tend to carry no load and the other full load. In the same way at full load for the two motors, one would carry half load and the other one and one-half load. The difference in load between the two motors in this case is always equal to that load on one motor which would be required to give a drop in speed equal to the difference in speed between the car wheels or drivers. With 4 per cent difference between the drivers the unbalancing would correspond to the load required to drop one motor four per cent in speed, or about double load on the basis of a drop of 2 per cent at full load.

This difficulty can be overcome in a single locomotive by keeping all drivers of the same diameter or by the use of side rods, but this is not feasible when a number of separate locomotives are to drive the same load. When it is borne in mind that the drivers of different locomotives may have as much as 6 per cent or 7 per cent difference between the diameters of their drivers, it is evident that the unbalancing of the load between two locomotives may amount to much more than their normal rated capacity unless the slip of the drivers equalizes them.

One method of equalizing the loads would be to drop the speed of all of the locomotives to that of the lowest one by connecting suitable resistances into their motor circuits. This would be effective for one given load but would not give suitable equalization for other loads. For example, with 6 per cent difference in diameter of drivers of two locomotives, one would tend, when running empty, to carry one and a half times load, receiving power from the line, while the other locomotive coupled to it would carry one and a half times load as a generator feeding back into the line. The use of resistance would lessen this extreme unbalancing but could not eliminate it entirely as there must be some load on the motors in order that the equalizing resistances may become effective. It is thus evident from the above that only an average equalization of load would be practicable.

The Ganz Company, of Budapest, has avoided, to a greater or less extent, a number of structural limitations in this motor by reducing the frequency of the supply system to 15 cycles per second instead of 25 cycles, the lowest in general commercial service in the country. This low frequency presents no particular disadvantages at the generator station except in the case of small steam turbines, which can have a maximum speed of only 900 r. p. m. The frequency of 15 cycles per second is equal to 1800 alternations per minute. which is equal to the number of generator poles multiplied by the revolutions per minute. As the least number of poles is two, the highest possible number of revolutions is 900. This speed is lower than desired for steam turbines, except those of large capacity.

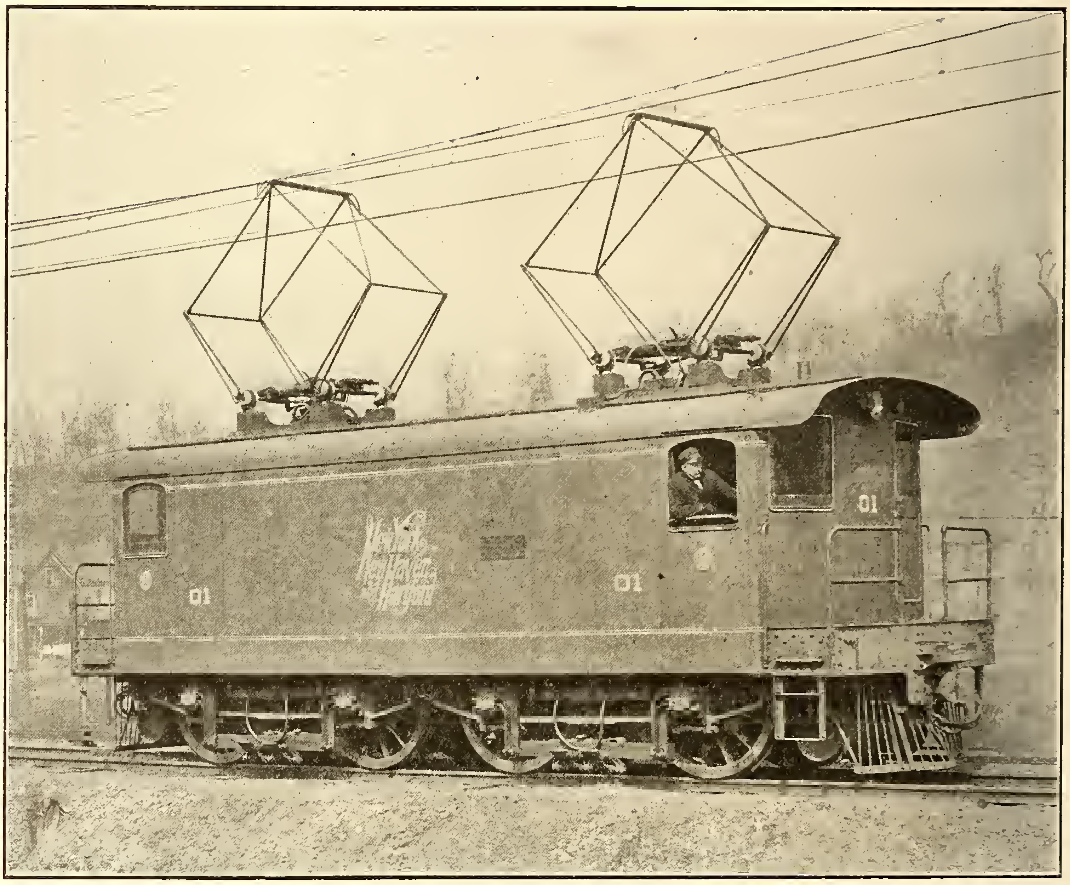
In the transmission line, however, the use of this low frequency in itself is advantageous, as it gives less line drop and loss than with 25 cycles. All transformers, however, become somewhat heavier. The real gain with this frequency is in the motor, which can be given better proportions and characteristics. Among the advantages claimed for this system is its ability to return power to the line under certain conditions. Above synchronous speed the induction motor acts as a generator, but it cannot deliver power efficiently except when running but slightly above synchronous speed. When running much above synchronous speed resistance must be connected in circuit and the efficiency in returning power to the line is affected.

ARNOLD'S ELECTRO-PNEUMATIC SYSTEM

Another method of solving this railway problem with high voltage trolley, was that proposed and tried by B. J. Arnold. He recognized at an early period the advantages that could be obtained with high voltage and a single trolley wire, and he, therefore, adopted single-phase alternating current for his supply system. The only motor available at that time for use on his single-phase trolley system was the single-phase induction motor. As already mentioned, this motor has very bad characteristics in regard to starting, overload capacity, etc., and Mr. Arnold, therefore, proposed to supplement the single-phase motor with certain compressed air appliances which would furnish the characteristics lacking in the motor itself. The motor was intended to run at or near its normal load most of the time, while the air apparatus was to do the starting and was to assist in taking care of abnormal conditions. Variable-speed operation was also to be obtained by means of the air apparatus. This system differs much from the preceding ones, and one notable feature was that the electrical apparatus was in reality a minor feature of the scheme, many of the desired locomotive characteristics being obtained by mechanical means as distinguished from electrical.

SINGLE-PHASE SYSTEM

By this time the problem was becoming better understood and at this stage another system was brought forward which was specifically designed to meet the varied conditions of heavy traction service. This system contains the following features:



THE FIRST COMBINATION SINGLE-PHASE AND DIRECT-CURRENT LOCOMOTIVE FOR THE NEW YORK, NEW HAVEN & HARTFORD RAILROAD

1st. Alternating current is used on account of its facilities for transformation.

2nd. One trolley wire only is used, by adopting single phase alternating current.

3rd. With alternating current and one trolley wire only. any desirable voltage can be used on the trolley line.

4th. By using alternating current an efficient means for varying the voltage to the motors is obtained. With single-phase there is one only supply circuit to be handled, and the variable voltage apparatus can be given the simplest and most efficient form.

5th. A type of motor was developed which can have its speed varied by varying the voltage supplied to it, and which uses power practically in proportion to the load, when operated in connection with the above variable voltage supply circuit.

6th. The motor is preferably wound for low voltage and the same transformer which is used for stepping down from the trolley voltage to the motor voltage can also be used for obtaining the desired voltage variation, for varying the speed, and the power in proportion to the speed.

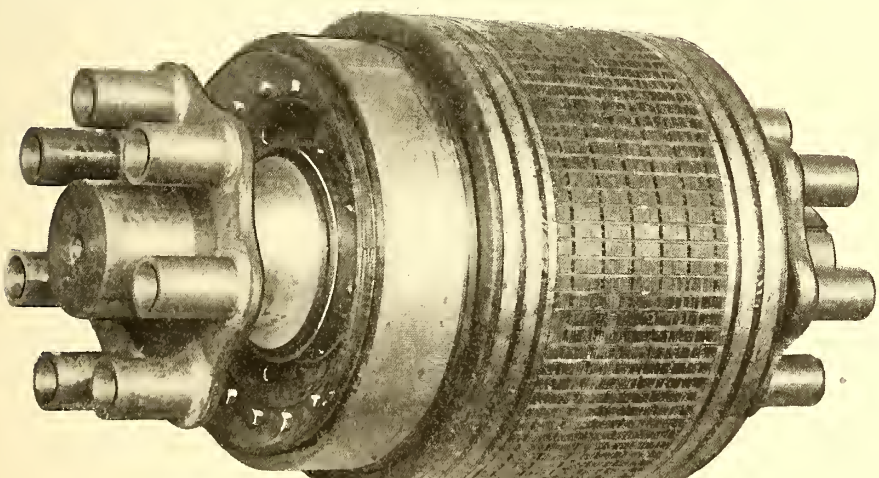
7th. The motor is inherently of a variable-speed type, and can automatically adjust its speed to that of other motors driving the same load, with but very small unbalancing of the loads on the individual motors.

8th. The type of motor developed is one which can be used on direct current also.

There are several variations in the types of single-phase motors used by the different manufacturers, but the principal features of the system are common to all. The equipment possesses the ability to operate at increased speed by increasing the voltage above the normal and can thus make up for lost time, when desired.

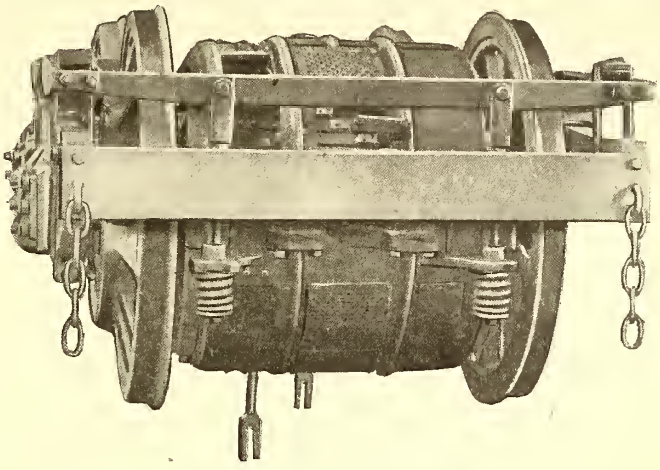
As mentioned before, it is important that under certain conditions an electric locomotive should be able to act as a brake, or to return energy to this line, as when taking loads down grade, for instance. There is but one way in which the car equipment can act as a brake; namely, by reversing the function of the motors and converting them into generators of power, the driving power being furnished by the train in movement. In acting as generators there are two ways in which an electric equipment can expend its power: First, by wasting it in resistance as heat, and second, by feeding it back into the line in case there is any other load on the line which can absorb the power.

The motors of the single phase system can readily meet the first of these conditions; namely, that of feeding power into a resistance. As the motors are of the commutator type, and are, in reality, first-class direct-current machines, they will readily pick up as d. c. generators and can feed power into a suitably proportioned resistance. This method of braking is perfectly feasible, provided the controlling apparatus and car circuits are arranged for this purpose.



ARMATURE COMPLETE, WITH QUILL SUSPENSION

Consider, next, the case of feeding power back into the line and controlling it. It would appear when looking at the problem broadly, that a motor which could have its speed and power varied so economically over a wide range, should also be capable of reversing its functions and becoming a generator of power with an economical control over a wide speed range; and it has been determined in an extended series of shop tests, that the single-phase type of railway motor does possess this property under certain conditions. A number of ways of doing this in a more or less successful manner have been tried. Some of these methods are very effective and permit practically perfect control of the power and speed during braking, or when returning energy to the line. Such an arrangement would probably not be advisable for merely stopping trains. Its true field would be in letting a train down a grade of such length that the power is returned to the line for a long enough period to represent a fair proportion of the total time of operation. Both this method and that where the power is absorbed in a rheostat, are valuable in relieving the wear of the brake shoes, which is a very important item on very long grades.



NEW HAVEN MOTOR IN POSITION ON TRUCK

The resistance method of braking, although not as efficient as the other, has one advantage, in that it is independent of the supply system. Therefore, in case the power goes off when the train is descending a grade, the resistance method of braking would still be effective.

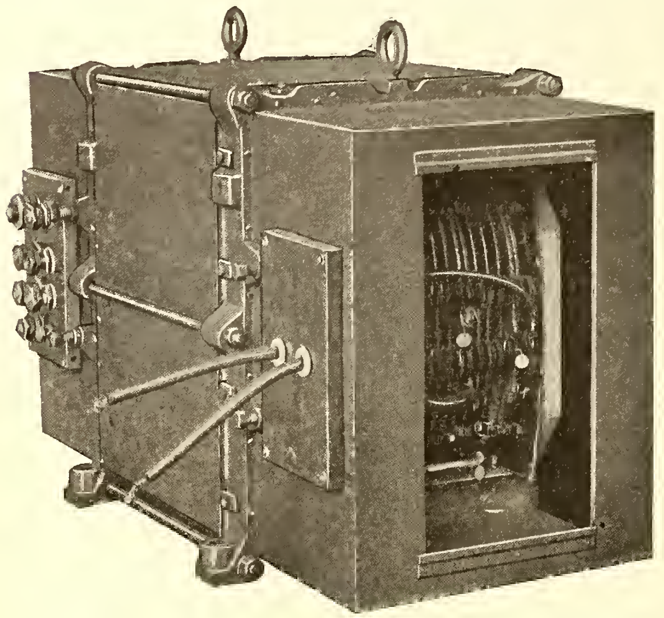
In the past few months, two contracts have been taken by the Westinghouse Electric & Manufacturing Company for single-phase railway equipment involving locomotives of steam railway size. These are for the equipment of part of the New York, New Haven & Hartford Railway system and for the electrification of the St. Clair or Sarnia tunnel, under the Detroit River, on the Grand Trunk Railway. The former equipment will operate under high-speed passenger service conditions, while the latter approximates freight locomotive conditions. A brief description of the former proposed installation may be of interest.

NEW HAVEN SINGLE-PHASE EQUIPMENT

In this case the problem is somewhat complicated by the fact that the locomotives must operate on direct current over the New York Central part of the New Haven system, and on alternating current on its own part of the line. However, this complication is not nearly as great as would appear at first thought, for the type of locomotive chosen is one which adapts itself well to both classes of service. However, there is necessarily some duplication of parts on the locomotive, such as the collecting devices, certain details of the controllers, wiring, etc. On the other hand, it is surprising how many parts are common to both classes of service. As the New Haven equipment in its alternating part embodies many features which have been carried out further than before, it may be of interest to describe it as a whole.

GENERATING PLANT

The main power house is at Riverside, about 3 miles from Stamford. The generators in this power house are to be driven by steam turbines. The machines have single-phase ratings of 3750-kw., or about 5500-kw on three-phase, the armature winding being such that three-phase current can be obtained from the same machine. The generators have two



ONE OF THE TWO STEP-DOWN TRANSFORMERS USED ON THE NEW HAVEN LOCOMOTIVE

poles and at 1500 r p. m. give 3000 alternations per minute or 25 cycles per second. A 5500-kw, three-phase, two-pole, 1500-r. p. m. generator would have been considered an impossibility only a short time ago. The design of these generators was one of the difficult problems in this undertaking. The difficulty, however, was in designing the machines in the first place, and after a suitable construction was worked out, the manufacture of these machines appears to be comparatively easy. The machines have an ample margin, both electrically and mechanically, and they are particularly well adapted for handling inductive loads. As an illustration of unusual conditions met with in the design of such machines, I will mention that a single complete armature coil weighs about 600 lbs. However, as the machines have only two poles, the total number of armature coils is relatively small. As a machine in such service is liable to have rather short circuits at times, the armature end windings are extremely well braced.

As these machines are to feed directly into the trolley system, they are wound for the normal trolley tension of 11,000 volts, and in consequence one terminal of each machine is always grounded when in service, as in usual practice with d. c. railway generators. This point has been fully kept in mind in the design of these machines.

As the New Haven Railway Company contemplates operating certain existing d. c. systems from this power house, it was decided to add an additional leg to the armature winding so that three-phase currents could be obtained for feeding into rotary converter stations for furnishing direct current for some d. c. lines which, at the present time, cannot be conveniently changed to straight a. c. The New Haven Company also has other fields for three-phase power which it proposes to take care of as soon as it is feasible to do so.

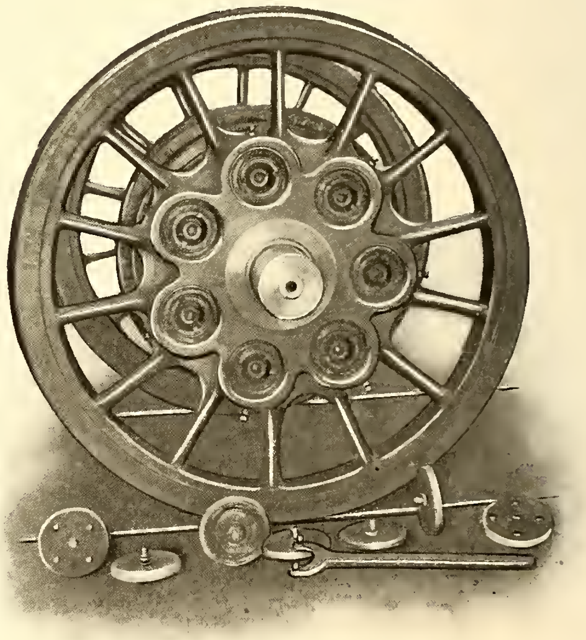
The steam turbines for driving these generators are of the Westinghouse-Parsons type. On account of the large output and high speed an unusually good performance is indicated. The engines are designed for the single-phase rating of the generators, as it is anticipated that the heavy service and the load peaks will be due to the railway load.

OVERHEAD TROLLEY SYSTEM

As 11,000 volts will be applied directly to an overhead trolley, and as the trolley system will span from four to six tracks, it is evident that a very substantial overhead construction must be used. The construction of this overhead system is one of the most interesting features in this whole electrical system.

The trolley system is to be suspended from steel bridges which span from four to six tracks normally, and even a greater number at special points. These bridges are placed at intervals of about 300 ft., and at points about 2 miles apart heavier structures, called anchor bridges, are placed. The steel cables which support the trolley wire proper are supported by massive insulators on the bridges. Two cables are used for each wire and form a double catenary suspension carrying the trolley wire by means of triangular supports. The double system of suspension gives increased stiffness to the trolley construction. The triangular supports are placed about 10 ft. apart. The steel cables have a total sag of about 6 ft., while the trolley wire itself is maintained in a practically horizontal position.

At points corresponding to the anchor bridges—that is, about 2 miles apart—each trolley wire is broken by section insulators and is connected to the other trolley wires and to two feeder wires through automatic circuit breakers. Otherwise each trolley wire, with its cables and supports, is insulated from the adjacent wires. In this way each wire is sectioned and a short circuit on any one section can cut it out without putting the neighboring wires out of service. The two feeder



DRIVING-WHEEL WITH CAPS REMOVED TO SHOW POCKETS FOR DRIVING PIN AND QUILL

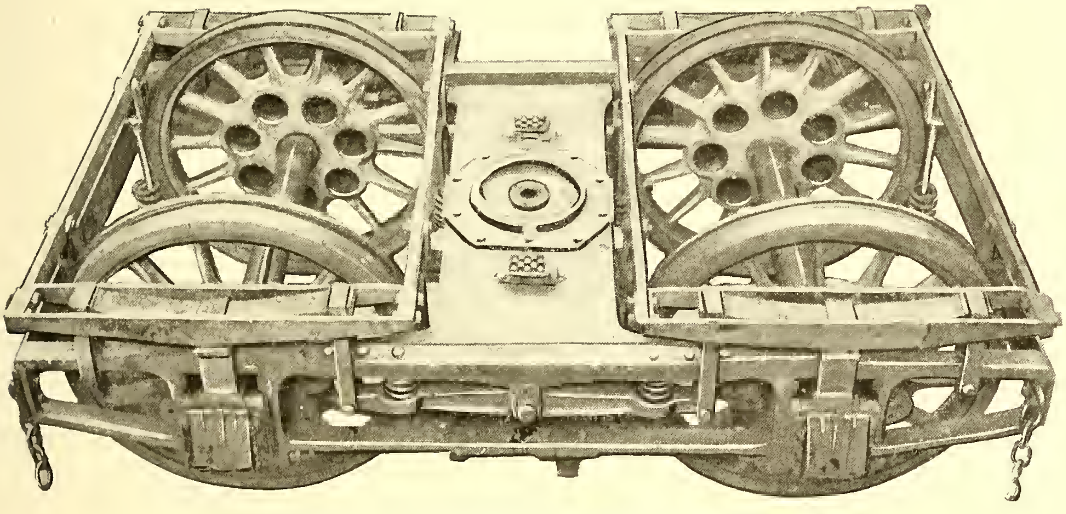
wires just mentioned are carried the whole length of the alternating system, and by means of these and the arrangement of automatic switches, any entire section of four or more trolleys could be cut out of service and the sections beyond can be kept in service.

The trolley wire has a nominal height of 22 ft. above the track. This height will vary a few inches up or down with wide variations in temperature. The pantagraph type of trolley used on the locomotives has an effective range of about

8½ ft. and therefore a very considerable variation in the height of trolley is permissible.

The overhead system is designed to be amply safe under abnormal conditions, such as high wind or heavy coating of ice. The stresses in the supporting cables with a load of ice ½-in. thick or 1-in. total, each side, on the cables, hangers, etc., will be about 1-6 of the ultimate. The stresses in the structure due to wind have been figured on a basis of 16 2-3 lbs. per sq. ft., projected surface for the cables and 25 lbs. per sq. ft. normal surface for flat surfaces. This is on a basis of the cables being covered with ice as given above. Allowance is made for double these pressures in summer when there is higher wind volocities, but under this condition the cables will be of much smaller diameter in the absence of ice.

As 11,000 volts is used on the trolley system, no transforming stations are necessary on the part which is now to be installed. The high voltage trolley system will extend about 19 miles in one direction from the power house and about 3 miles in the opposite direction to Stamford. This system could be extended in the latter direction approximately 20 miles further, if desired, without transforming sub-stations. Therefore about 40 miles of the trolley system can be supplied directly from the main power house. With a locomotive load representing 4000 kw about 19 miles from the power house and a corresponding load 15 miles away, or 4 miles from the power house, the drop at the end of the line will be about 13 per cent. This drop is on the basis of feeding into the load from one direction only. If there were a transforming substation about 40 miles away from the power house, feeding into the same trolley system, then the drop at a point 20 miles away would not be 13 per cent, but would be considerably less as power would be supplied from both directions. It is apparent therefore, that with sub-stations along the line feeding into a common trolley system, such sub-stations could be possibly 60 miles apart. For example, if a transforming sub-station were placed in New Haven, about 40 miles away from the power house, the drop at the midway point between the sub-station and power house would be equivalent to a load on the present system at 10 to 15 miles from the power house. However, the above distances between sub-stations are so great that it might prove inadvisable to feed more than one or two sub-stations from a given plant, two or more power plants being installed on a very long system.



THE NEW HAVEN TRUCK WITHOUT THE MOTORS

THE LOCOMOTIVE

This is the part of the electrical equipment which will doubtless excite the most interest, principally because it is a newcomer in an old field. From the standpoint of the designer the generating system and overhead construction may present just as interesting features, but to the layman in the electrical field there is but little with which to make comparison; but when it comes to the locomotive the general problem is much better understood.

The frame, trucks and cab of this locomotive were built by the Baldwin Locomotive Company, on designs developed after many conferences between the New Haven Railroad Company, the Baldwin Locomotive Company and the Westinghouse Electric & Manufacturing Company. The design adopted was partially determined by the fact that the motor equipment must be suitable for use on both alternating and direct current. This to a certain extent controlled the number and size of the motors and thus affected the construction of the trucks and other parts. The results have turned out so well, however, that there is every reason to believe that this type of locomotive will be used in future even where alternating current alone is used.

The mechanical construction of the locomotive presents many novel and interesting features which deserve special consideration. The running gear consists of two trucks, each mounted on four 62-in. driving wheels. The length of wheel base is 8 ft. The side frames are of forged steel and to them are bolted and riveted the pressed steel bolster carrying the center plate. The weight on the journal boxes is carried by semi-elliptic springs with auxiliary coiled springs under the ends of the equalizer bars, to assist in restoring equilibrium. The bolsters are 30 ins. wide at the center plate and are widened, when bolted to the side frames, to nearly double this amount, thus giving a very strong construction without excessive weight. The center plate which transmits the tractive effort to the frame is 18 ins. in diameter and will be lubricated to permit a perfectly free motion in curving. The truck centers are 14 ft. 6 ins. apart.

Owing to the fact that the entire space between the wheels is occupied by the motors, it was impossible to transmit the drawbar pull through the center line of the locomotive in the usual way. Instead of this, strong plate girders heavily cross braced are carried outside of the wheels and the entire strain of the drawbar is carried to these through strong box girders having top and bottom plates 42 ins. wide. Directly underneath the girder at each end is a Westinghouse friction draft gear to which the drawbar is attached. The entire design lends itself to a very strong construction without great weight. The cab is built up of sheet steel on a framework of "Z" bars. The apparatus inside the cab is carried on a framework of structural steel which is built into the cab and firmly anchored to floor and ceiling. Over each motor is a large trap door which permits easy access to motor bearings, brushes, etc.

The motors are four in number, each of 250-hp nominal capacity but with a continuous capacity of over 200-hp. each or over 800-hp total. The motors are of the gearless type and are wound for a normal full load of speed of about 225 r. p. m.

They are connected permanently in pairs and require about 450 volts at the terminals on alternating current and 550 to 600 volts on direct current.

The frame and field of each motor are split horizontally and can be removed in halves in order to give access to the inside of the field or to the armature. The armature is not placed directly on a shaft but is built up on a quill through which the car axle passes with about ⅝ ins. clearance all around. On this quill, at each end, are placed bearings which carry the field frame.

At each end of the quill is a flange from which projects seven round pins, parallel to the shaft, into corresponding pockets in the hub of the wheel. Around each pin is placed a coiled spring wound with the turns progressively eccentric. These springs are contained between two steel bushings, the smaller of which slips over the pin, and the larger fits in the pocket in the wheel. These springs are amply strong to carry the entire weight of the motor but are normally required to transmit only the torque of the motor and to keep the motor axis parallel to the axle. They allow a total vertical movement of about ¾-in. The end play of the motor, instead of coming directly on the wheels, is taken by strong coiled springs inside of the driving pins which press against covers in the outer ends of the spring pockets in the wheels. The torque on the motor frame is taken by heavy parallel rods which anchor the frame to the truck above and below the axle. These rods permit vertical or side motion of the motor but prevent excessive bumping strains from coming on the motor driving springs. The entire weight of the motor is normally carried on springs supported from a steel frame surrounding the motor and resting on the journal boxes.

The motors are internally of the same general type which the Westinghouse Company has been building for some time for interurban service. However, due to the relatively low speed of the motors, the maximum commutator speed is very low, being less than 3000 ft. per minute when the locomotive is making 60 m. p. h. This may be compared with 5000 to 7000 ft. commutator speeds which are frequently attained in both d. c. and a. c. high-speed service with fairly large motors.

One interesting feature in these motors is the method of cooling. As a blower is used in the locomotive for cooling the lower transformers it was decided to extend this method of cooling to the motors also. In the floor of the cab is an air conduit of considerable size from which air is piped to each motor. This method of cooling improves the continuous capacity of the motors, as evidenced by the above figures, which show that the continuous rating is almost equal to the one hour rating. A further very great advantage in this method of cooling lies in the fact that the motors can be kept very clean in this manner, as the inside of the motor is kept under partial pressure at all times, tending to keep out dust and dirt, as all air flow is outward. The air furnished to the motor, being taken from the inside of the cab, can be kept relatively clean and dry.

On the direct current part of the line, current is taken from the third rail system, except in the case of some short sections at cross-overs fed from an overhead trolley on direct current. The motors are controlled in the usual series parallel method in combination with resistance, as in ordinary d. c. practice.

On alternating current the motors are not operated in series parallel as on d. c., but are connected permanently in a given manner and the supply voltage is varied. This gives an equivalent of the series parallel, except that the number of efficient operating steps is much greater. On a. c. operation no resistance is used in regular running, but a slight amount is used in passing from one working step to the next, this being in the nature of a preventive device to diminish the short circuiting effect when passing from one transformer tap to another. There are six operative voltages, or running points, on the a. c., corresponding to six taps on the lowering transformer, while there are a small number of intermediate steps, which are used only in passing from one working point to another. Experience has shown that the number of steps on a. c. required to give a smooth acceleration is considerably smaller than required on d. c. In consequence the controller is so arranged that on a. c. about half as many steps are used as on d. c. The tests have shown that the acceleration on both a. c. and d. c. is very smooth.

There is one feature in the d. c. control which is not generally found at the present time on direct-current equipments, namely, shunting the field for higher speeds. On the series position on d. c. the motors have an efficient running point. It is usual railway practice to pass from the series to multiple position by introduction of resistance, there being no immediate efficient running speed. On the New Haven equipments, however, the type of motor used is one which permits an almost indefinite shunting of the field without affecting the commutation or operation otherwise, and advantage is taken of this to obtain several higher speeds by shunting the fields before passing into multiple. In this way several efficient running points are obtained between the series and multiple. The tests have shown that these motors will operate in a perfectly satisfactory manner on direct current with their fields shunted down to much less than half their normal strength.

When operated on direct current, as stated before, the current is fed directly to the motors. On alternating current, however, step-down transformers must be used, as the a. c. trolley voltage is 11,000. The step-down transformers are two in number, one on each side of the cab, in order to balance the weight in the cab. It must be borne in mind that these transformers are the heaviest single pieces in the cab, and there would be considerable difficulty in placing a single transformer to advantage. A further reason for two transformers is that an injury to one would not entirely disable the locomotive. The transformers are connected in parallel across the high voltage, but on the low voltage side each transformer feeds one pair of motors, through a separate control unit. This means that the controller when operated on a. c. consists of two normally independent units.

The main controllers are of the well-known Westinghouse electro-pneumatic unit switch type. The design, however, differs somewhat from the straight d. c. type, due to the fact that switches, blow-outs, etc., must operate on both alternating and direct current, as many parts of the controller are common to both. It may be mentioned also that the reversing switches are of the unit switch type.

The main controllers are operated from master controllers at each end of the cab. The controller system is arranged for multiple unit operation so that two or more locomotives may be coupled to the same load.

In addition to the controlling and transforming apparatus there is a number of auxiliary parts, such as two air compressors driven by motors which can be operated on either a. c. or d. c.; two blowers driven by similar motors, for furnishing air to the transformer and motors, and to the d. c. rheostat. It may be mentioned that the air which passes through the transformers is also sent through the rheostats. When operating an a. c. the transformer is heating the air which passes through, and this air would not be very effective in cooling the rheostat. However, when running on d. c. the transformer is idle, and the air passing through becomes effective in the rheostat.

In addition to the above auxiliary apparatus there are oil circuit breakers for the high tension a. c. switches for throwing from a. c. to d. c., and many other details which would be found in any electric locomotive. There is also a steam generator in the cab for the purpose of generating sufficient steam for heating the coaches in cold weather.

The locomotive is equipped with devices for collecting both alternating and direct current. For the latter there are eight collecting shoes, four on each side of the locomotive, arranged in pairs of two each. There are, of course, two pair on each side, one at each end, for the purpose of bridging such gaps as are necessary in the third rail system. There must be shoes on each side, as the locomotive must be able to make contact with the third rail when turned end about. These d. c. contact shoes must also be able to work on two forms of third rail, one in which the shoe runs under the rail and the other where the shoe runs on top of the rail. The locomotive is provided with a pantagraph low tension overhead d. c. trolley to conform with certain New York Central requirements.

For collecting alternating current the locomotive is provided with two pantagraph-type high-tension bow trolleys. Each trolley has a capacity to carry the total line current under average conditions, but two are provided to insure reserve capacity.

Each of these locomotives is to be able to handle a 200-ton train in local service on a schedule of 26 m. p. h., with stops averaging about 2 miles apart. In order to make this average speed the maximun speed will be about 45 m. p. h. One locomotive will also be able to handle a 250-ton train on through service. For heavier trains than this it is intended to couple two locomotives together and operate them in multiple. This presents no difficulties, for, as stated before, the locomotives are fitted up for the multiple unit system of control.

It is evident from the above description that the engineers of the New Haven Railway Company have had in view the adoption of an electric system which is particularly well adapted for future extensions. If the electrification were to stop at Stamford, then the full advantage of the alternating system would not be obtained. However, the section which will be electrified with alternating current is of sufficient length to enable the New Haven Railway engineers to determine the advantages and possibilities for future extension, and it is safe to predict that such extensions will be made in a comparatively short time.

SARNIA TUNNEL

As this system as a whole has been very fully described in various technical journals, it is not necessary to go into it more fully at the present time. (See STREET RAILWAY JOURNAL of Jan. 20, 1906.)

REMARKS BY MR. LAMME'S ASSISTANT IN SHOWING LANTERN SLIDES

A number of lantern slides of the New Haven locomotives were then thrown on the scene. In explanation of these views Mr. Lamme's assistant said:

Up to the present time the New Haven locomotive has run about 2000 miles. This run has been conducted on a test track a mile in length, so that during this run the locomotive has made 2000 stops. In addition to the two pantagraph trolleys illustrated in the first engraving in Mr. Lamme's paper, the locomotive has a low-pantagraph trolley midway between the two for use on the overhead section of the New York Central tracks, and is also equipped with third-rail shoes for use on the third-rail section of the New York Central Railroad. The weight of the locomotive is 85 tons, and its average acceleration is 0.45 m. p. h. p. s. The motors are ventilated through ducts tapped through the motor frame near the commutator end of the machine, and screened to prevent the entrance of dust. The switches for connections are operated pneumatically. The grid resistances are carried on one side of the center aisle of the locomotive body and the transformers on the other side. The master controller is not arranged with a revolving handle as with most controllers, but with a lever similar to the throttle handle on a steam locomotive and moving through an arc of 96 degs. The reversing handle is a shorter lever directly below the operating handle.

ABSTRACT OF DISCUSSION

W. J. Wilgus, vice-president of the New York Central Railroad, said the interesting address by Mr. Lamme raised the question in the minds of steam railroad men as to the motives that should guide them in advocating a change of motive power from steam to electricity. These motives, in the majority of instances, are based upon one or both of the following conditions, namely, the desire or necessity to abate smoke nuisances in tunnels or terminals in large cities; or the improvement of passenger service to attract an increased patronage by the public. In other words, steam railroad companies at the present stage of the development of electricity as a motive power, do not consider its use from motives of economy but from those of necessity or from the broader policy of improving public service. To accomplish these objects safety, reliability and earning capacity should be borne in mind. Whichever electric system is adopted, full consideration must be given to the question of safety to the employees of the company and to the public. More or less has been stated in the press about the decreased dangers from collisions with the use of electricity and increased dangers from the use of working conductors conveying electricity to locomotives and cars. On the former point there is little to be said at this discussion, but on the latter point we have before us at once the selection between the third-rail working conductor with direct current, and the overhead construction with alternating current. It may be said that both forms of construction have their disadvantages but, properly installed, neither may be said to offer any more cause for apprehension on the part of railroad men or the public than elements of danger that exist with ordinary steam railroad equipment, as, for instance, boilers carrying pressures and fires on steam locomotives. As between these two forms of construction, however, there has been more or less heated discussion and, as a rule, the impression seems to have gone forth that the third rail is dangerous and that the overhead construction is absolutely safe.

He would not like to be considered as condemning either, as he felt that there will always be local conditions that will require the use of either or both. He thought, however, that it is only fair that the advantages and disadvantages of both should be made plain to those who are contemplating the future change from steam to electricity. Properly designed and protected, the third rail may be said to have the disadvantages of impedance with ordinary maintenance of track and danger from derailments. Other objections have been made, as, for instance, troubles with snow and sleet, complications at frogs and switches, difficulties of current collection and great danger to employees and trespassers. Extended experiments under his direction have proven the fallacy of these objections, provided the rail is properly designed and protected. Objection has also been made to the use of third rail because of interference with the clearance lines of equipment, but inasmuch as several trunk-line railroads have already adopted third rail, so as to fix the standard outlines of equipment, other railroads must naturally adjust the outlines of their equipment to the clearance diagram that has already been adopted to fit third-rail conditions in order that traffic may be interchanged.

Overhead construction has the following disadvantages:

Inelasticity of construction, which prevents the laying of additional tracks or changes of grade and alignment without requiring radical expensive alterations in the permanent overhead structures. For instance, it has recently been necessary in the electrification of about 50 miles of double-track on the West Shore Railroad to decide in favor of third rail because by so doing $400,000 was saved that otherwise must have been spent for the increased cost of the overhead construction designed for anticipated future conditions that might not become necessary for between five and ten years.

Danger to trainmen on the tops of freight cars.

Danger to the public at overhead street and highway bridges.

Danger to trains in tunnels and at other places with restricted clearances, owing to the possibility of rearing cars in cases of collision or derailment, making contact with the highly charged conductor.

Danger from derailments knocking down a supporting structure, which would effect not only the track upon which the derailment occurs, but also all tracks on, for instance, a four-track railroad, with the possibility of accident to more than one train; and danger to trains where the overhead conductor carrying, for instance, 11,000 volts, is within two or three feet of moving cars, and corrosion due to freight locomotive gases.

On the question of safety it may, therefore, be concluded that properly designed working conductors, either third rail or overhead, offer as much safety as is now enjoyed with present steam railroad equipment, that both types of working conductors are necessary for the full development of the art, and that as between direct-current systems with third rail and alternating-current systems with overhead construction, a selection of either may be made properly to fit local conditions, with the preference from a non-electrical standpoint in favor of third rail.

To meet the argument about the possible failure of the power house, it seems imperative that those charged with the responsibility of changing motive power from steam to electricity must reduce to a minimum the chances for a wholesale interruption of traffic. To obtain this object, the power stations may be constructed in duplicate, so that in case of the failure of one the other, by utilizing its overload capacity and spare units, will permit the entire system to be operated, although possibly with some reduction of efficiency. The New York Central & Hudson River Railroad has adopted the two power station idea. The first impulse may be to criticise this policy as expensive, but it should be borne in mind that by so doing the requirement of reliability is obtained and moreover, as those operating the system become expert in preventing troubles, the surplus power may be utilized for taking care of the expanding traffic of the company. Already his company sees ahead the necessity for the use of this surplus energy, and in the meantime is amply protected against the usual troubles in starting a new system.

The transmission line should, where possible, be in duplicate, and the working conductor should not be utilized for transmission purposes. In other words, the working conductor should be sectionalized, so that in case of breaks of any kind the trouble will be confined to the section in question, leaving the remainder of the road to be operated without delay to trains.

To guard against interruption of service, batteries have been considered a necessity on trunk line railroads. This has been urged not only by the advocates of direct current but by some of those most prominent in the alternating-current field, and it is, therefore, somewhat surprising that those who have been the most urgent in their advocacy of batteries for direct-current installation should now consider them unnecessary where they are advising the use of alternating current. Certainly conservative railroading on trunk lines carrying frequent passenger, mail and express trains should leave no stone unturned to guard against interruption of traffic. If this is conceded, the cost of batteries is just as legitimate a charge against the use of alternating-current electric systems for heavy railway service as for the direct-current system, and even more so if but one power station is used, as contemplated in the system described by Mr. Lamme.

The relative technical advantages of alternating-current and direct-current systems for heavy railway service Mr. Wilgus said he would leave to those who would follow, merely calling attention to the wisdom of adopting the system not only best suited to local needs, but the one which by long experience or careful experiment is proven to be worthy of adoption in such a revolutionary step in districts where a failure would be disastrous. The responsibility on the steam railroad men of the change from one kind of power to another is sufficiently heavy without adding to it the use of untried systems.

Mr. Wilgus also spoke in favor of multiple-unit operation for suburban service.

MR. TOWNLEY'S REMARKS

Calvert Townley, consulting engineer of the New York, New Haven & Hartford Railroad, said that he would not enter into a direct discussion of the paper, as Mr. Lamme had carefully covered the various possibilities of alternating current for railway work, but he could perhaps contribute the point of view taken by the New Haven Railroad in its prospective adoption of electric traction for a limited part of its New York-Boston division. No one claims that the alternating-current locomotive of to-day is going to be the one of ten years hence. All that can be said is that it is the best available now and that it is good enough to try. The limitations of the steam locomotive have been long recognized by steam railroad men, but in the absence of something better they have made the best of it. The electric locomotive is equivalent to a steam locomotive with its boiler taken somewhere else, and the electric system is the equivalent of a large number of locomotives with their boilers concentrated at any desired point. This means that instead of securing only the limited amount of power capable of being received by the firing of one locomotive, it is possible to use the power from what would be equivalent to the work of all the firemen and all the locomotives. This comparison is not strictly true, but it illustrates the adaptability of the electric locomotive to do a tremendous amount of work for a considerable period without damage. When one comes to heavy freight or passenger traffic, therefore, he is not limited by the length of the train or by inability to maintain the given speed. Without strengthening the bridges or roadbed, or increasing the weight on the drivers, it is possible to use two or more locomotives on a multiple-unit system and secure any desired tractive effort, size of train unit and speed. The result is to secure an increase of track capacity, which is of even more importance in congested districts than the question of train or engine-mile costs.

Taking up the point of view of the New Haven Railroad, he said that if one were to examine the railway map of Southern New England he would note that the New Haven system is not a single long line, but is a network. Its customers are the numerous manufacturing towns spread out through Connecticut, Rhode Island and Massachusetts. This condition, of course, makes for congested traffic. For a considerable part of their length the New Haven lines are reasonably near to tidewater, and this, coupled with the numerous water powers in New England, makes for the cheap generation of power. The New Haven system is, therefore, well adapted for electrification, perhaps more so than any other. In taking up this question of electrification, future necessities should be borne in mind as well as those of the immediate present, and although the problem was originally taken up because it was necessary to enter New York electrically, the latter fact was not the deciding factor in deciding upon what type of electrical equipment would prove the more successful. When one considers electrification over such a distance as, say, New York to New Haven, which is about 73 miles, with possible extensions to New London, Hartford, Springfield and Boston, it is necessary to provide not only for a suburban traffic but a long-haul traffic with heavy units at intervals which may be termed infrequent as compared with trolley-car service. Therefore, the capacity of the line at any one point should not be dependent upon the ordinary d. c. sub-station methods which would greatly increase the expense. The question of reliability is one which has appealed to the New Haven road as having the prior place. In the system proposed by Mr. Lamme there is only one link between the bus-bar and the locomotive, namely, the trolley wire. It seems reasonable to say that this one link is less liable to cause trouble than if we substitute for the single trolley wire, first, an 11,000-volt three-phase transmission system ; second, a high-tension switchboard ; third, step-down transformers ; fourth, rotary converters ; fifth, d. c. switchboard ; sixth, a storage battery ; seventh, a system of d. c. feeders, and eighth, a 600-volt d. c. trolley wire. On the other side, there was the possible trouble incurred by using a high-tension current collection, as against the ordinary 600-volt trolley system. But continued investigation did not seem to warrant the assumption that such additional risk caused by using 11,000-volt trolley wire, would give anywhere near the possibilities for trouble as where seven or eight links intervened between the power house and the locomotives. As to the cost of operation, the method adopted by the New Haven Railroad eliminates all sub-station operation expense, and, taking all the other factors into consideration, the total efficiency of the whole system, from boiler to wheel, is at least 10 per cent better than with direct current. When it comes to a question of additional lines, it will be possible to take care of the greatly increased service with the 11,000-volt trolley without introducing any continued maintenance expenses except that of maintaining overhead construction. Another point is that whereas high-tension single-phase current for heavy traction can be used on an overhead system and direct current practically cannot, yet, in places like tunnels, under bridges, at crossings or close clearances, it is always possible to use a lower alternating current voltage for any desired distance. Consequently the alternating current does not bar the use of any voltage found feasible under the prevailing conditions. Commenting on the criticism as regards the cutting off of power by the breaking of the trolley wire, it will be noted from the paper that about every 2 miles each trolley wire is broken by section insulators, and is connected to the other trolley wires and to two feeder wires through automatic circuit breakers. Otherwise each trolley wire, with its cables and supports, is insulated from the adjacent wires. In this way each wire is sectioned and a short circuit on any one section can cut it out without putting the neighboring wires out of service. The two feeders are carried the entire length of the alternating-current system, and by means of these and the automatic switches any entire section of one, two, three or more trolley wires could be cut out and the sections beyond be kept in service.

The New Haven road also has another problem confronting it. It controls a system of trolley lines throughout Connecticut and desires to utilize the trolley properties in connection with a number of the steam branches of the New Haven system which do not serve very populous sections. With the local trolley systems it is possible to give a more frequent service and better train connection with the principal centers of population and thus contribute to increased business progress. By using alternating-current for these branches as they are electrified from time to time, it will be possible to operate main line trains over the branch lines whenever the conditions make it necessary, and thus a uniform system will be secured throughout.

MR. SPRAGUE'S REMARKS.

Mr. Sprague, of the New York Central Electrical Commission, while expressing confidence in a great future, said that because of the magnitude of the interests involved it was necessary to temper optimism with conservatism. The question of dollars and cents determined the ultimate measure of development, and a dividend was the final arbiter of commercial success.

He had been much interested in Mr. Lamme's paper, which was important not alone for what it contained, but also for what it omitted, for it was not a discussion of the advisability of electric operation on trunk line railways, but rather a specific plea for the substitution of single-phase electric locomotives operated directly at high tension in the place of steam locomotives. Of course electric locomotives of ample power could be built and operated in a variety of ways, but there were questions much broader than matters of technical accomplishment which would be found controlling. His attitude in the matter of electric operation of trunk lines had been stated many times, and he would only briefly refer to some fundamental facts. Electricity was simply an agent for the transmission of energy. It was possible by its use to concentrate at a central station the power necessary to operate the various sections of a railroad, and with a well-distributed load and good load factor to show power economy. It was also possible by the multiple-unit system not only to concentrate an enormous power by combination of units under a common control, and thereby not only increase capacity, but establish practically the ideal conditions of passenger transportation, the operation at frequent intervals of train units varying in length according to traffic requirements. It was equally true that much higher potentials had to be used on the working conductors if results hoped for were to be realized.

The wisdom of adopting electricity in trunk line transportation was really more a financial than a technical question. Leaving out special problems such as the operation at terminals, in tunnels or on concentrated grades, there are but two broad grounds on which a steam-operated trunk line railroad could consider the adoption of electricity; first, hope of reduction in working expenses by simply replacing the steam locomotive by an electric one, with concentration of prime power and possible use of waterpower at a central station, and without change in the general character of the service, in which case every train in the electrified district, freight as well as passenger, should be handled electrically; and second, because of the use of electricity not only might there be some gain in economy but something achieved impossible to steam operation,—for example, such a radical change in train service as will be effective in inducing increase of passenger traffic or increase of capacity of a road of limited trackage.

Any partial step, such as in the former case operating passenger service by electric locomotives and leaving freight to be operated by steam, or in the latter case refusing to take advantage of that method of electrical operation which has become so pronounced in practice and benefits was likely to leave a railroad between the devil and the deep sea, and when the auditor's accounts were rendered to be so destitute of satisfactory showing as to possibly discourage electric operation.

Generally speaking, comparative density of traffic was an absolute essential of success from an economic standpoint, and a fundamental essential is the building up of territory and the encouraging of travel by a high speed frequent service. In fact, on any road which has a competitive suburban territory he believed that money spent in developing the highest type of a frequent and speedy motor-car train service would be more productive of favorable financial results than could be shown by change from steam to electric locomotive operation without improvement of train service.

Among the general electric developments in our immediate neighborhood were those on the New York Central and the New York & New Haven railroads, and the question was pertinent: Why did either of these great systems adopt electricity? In some measure the former was obliged to, being compelled by law to abandon the use of steam in the tunnel, and to that extent a similar condition governed the New Haven Company. Physical conditions made it necessary to do more than the law required, and it seemed wise to establish such a character of suburban service as would partly justify the great expense.

The New Haven road had apparently adopted a different view, and this was the basis of certain criticisms which had appeared in the STREET RAILWAY JOURNAL of Oct. 21, 1905.

Mr. Sprague briefly reviewed the objections raised at that time, which were based in part on technical facts, and to a greater degree upon the special conditions surrounding operations at a common terminal, which seemed to him to unduly handicap not only the a. c. development, but electrical operation as a whole. So far as actual developments had taken place, or public announcement been made, he believed that his criticisms were in the main fully justified.

Referring to Mr. Lamme's general description of the three principal methods of operation, Mr. Sprague said each was practicable and had certain specific advantages, but he must condemn the assumption that past practice measured the limit of potential in d. c. operation. He had predicted raising the direct-current standard for some classes of work to at least 1500 volts, and wished to repeat without reserve that not only was this increase possible with modified forms of construction, but it made practicable the resuscitation and adaptation for locomotive use of early and effective methods of variable-speed control.

It has been incorrectly stated at a former meeting of the club that a continuous-current locomotive had but two economic speeds. In the ordinary d. c. equipment the motors were given two impressed electromotive forces, half and full, by the series parallel control, and with a 4-motor equipment there were three impressed electromotive forces; in each combination there was for any definite current and torque a certain speed, but with each the entire range of speed, after leaving the resistance control, was an economic one.

Since it has been stated that the power to make up time was one of two factors which alone would be sufficient reason for adoption of single-phase operation, it was of special interest to note that Mr. Lamme emphasized the fact that, even with the plain series motor, there is possible a wide range of economic speed control by field variation alone, while maintaining a constant torque. Hence this assumed advantage seems to have already largely disappeared.

The special improvements which had been referred to made possible a range of several hundred per cent in economic speed at will, with any desired graduation, and a like range of return of current to the line where such was advisable. These developments contained the promise of effective results in certain difficult classes of railroad operation.

It had been stated that the storage battery as a reserve was available to the single-phase a. c. system, but, of course, the only possibility was by the introduction at sub-stations of rotating machinery, held to be such a bugbear in d. c. operation, and then only under conditions of serious energy losses, as illustrated in the plans of a certain western road. There a polyphase synchronous a. c. motor is to drive a single-phase generator, and to the same shaft is coupled a direct-current machine which, with light line loads, will charge the storage battery and when the line load increases, with consequent slowing down of the synchronous motor, it will reverse its function, and taking current from the battery help drive the single-phase generator. About half of the electric energy, after leaving the original power station, will undergo six transformations, and the other half ten transformations before reaching the motors on the car.

Much had been said on the subject of electrolysis, which trouble had been held as individual to the d. c. system. That such has taken place was undeniable, but largely because of local conditions. Most electric railways in the localities instanced had their tracks laid in intimate contact with the earth. They ramified in all direction on streets filled with leaky sewer, gas and water pipes. The ground was at times saturated with rain and other liquids—with resulting conditions especially favorable to electrolysis. On a trunk line railway conditions were essentially different. Heavy traffic rails of enormous current capacity were carried on wooden sleepers embedded in well-drained broken stone ballast. Being on a reserved right of way, they were well removed from gas and water pipes, and little apprehension need be felt. In this connection he quoted some recent remarks by A. P. Trotter, the electrical expert of the British Board of Trade, under whose jurisdiction all electric railway installations in England were now made, as they appeared in the February, 1906, issue of the Transactions of the Faraday Society, of which Lord Kelvin is president.

Mr. Sprague said that it is not the volume of current on the rail that determines the amount of electrolysis, but the difference and character of potential which exists in the different parts of the track and the facility offered to the flow of current because of that difference of potential to other metal conductors. But the single-phase a. c. system had a special difficulty of its own. When using pressures as high as 11,000 volts, even with only 5 per cent loss on the rails, there would be a mean difference of potential on the tracks of 550 volts, with a maximum of nearly 800 volts. Leaving out the question of electrolysis, which there is good reason for believing will take place, there were serious possibilities of interference with lightly insulated telephone and grounded telegraph services, the latter operating with phantom circuits in the duplex and quadruplex systems.

Referring to the economic advantages of high-tension operation, he reminded his hearers that he had always been the advocate of higher potentials, and believed that, whether with a. c. or d. c., it would be necessary on occasion to go to the highest permissible limits, but here again came up a new fact, for the higher the potential the greater the necessity for concentrating motor equipments in a single unit, whether it be a car or locomotive, for we could not view without apprehension the project of introducing into the several cars of a passenger train made up wholly or partly of motor cars of the very high potentials contemplated in long distance infrequent locomotive service. It is, therefore, quite possible that different standards of potential would be adapted on different parts of the same line.

In discussing pressures, conductor capacity and costs, some elementary facts should be borne in mind. When subjected to single-phase currents all conductors labored under some of the same disadvantages as does a motor, and a steel track rail especially so. Under average conditions as to size, frequency and power factor, a copper trolley wire will offer about one and a half times, and a steel rail about six and a half times, as much total apparent resistance to a single-phase alternating current as the same conductors will offer to a direct current of like volume.

Comparing the actual capacity of tracks and conductors as to be installed on the New York Central, the total apparent resistance per mile of the latter will be about six and a half times as much as that of the former to like volumes of the two currents. This practically meant that if the two roads had sub-stations the same distance apart, then with the same loads and line losses, the mean pressures required on an a. c. system would be over two and a half times as much as on the d. c., and the maximum pressure over three and a half times. For example, operation with a direct current at 1500 volts would give the same line losses as operation with a single-phase a. c. at a mean pressure of about 3000 volts, and a maximum of 5400.

Mr. Townley had stated that in place of the normal high-tension overhead trolley a low-pressure third rail could be installed wherever along the line limited tunnel and road crossing clearances will not permit the former, and also that terminal yards could be similarly equipped. Momentary shiftings from high to low pressures and vice versa are not enviable operating conditions. With a tunnel of some length and in yards an a. c. third rail is possible, but only and with special construction. Single-phase operation is essentially a high pressure and copper conductor proposition, and the ordinary steel third rail is practically barred to it. The mean a. c. pressure can only be about seven-tenths of that allowable on the d. c. system, with resultant current increase, irrespective of how it is transformed. On account of the high rail impedance the result is very much as if on a d. c. system the pressure were reduced a third and, with the increased current, a 10-lb. or 15-lb. iron rail were generally adopted. A copper conductor would, therefore, have to be used, and even then the low power factor, the greatly increased currents, the extra resistance of the equivalent copper conductor and the high impedance of the traffic rails would constitute almost prohibitive operating conditions.

On the subject of working conductors much has been said—and very truly—about the dangers of the ordinary third rail, and the difficulties attending its use in times of sleet and snow. The sleet objection, as well as some other serious ones, can certainly also be raised against the overhead system. As to the third rail, he was glad that Mr. Wilgus has brought out the part that recognizes the defects in the existing practice, and realizing the serious possibilities of delay and stoppage of service unless they were overcome, there has been developed in connection with the New York Central work a protected third rail, which, when submitted to severe snow and sleet conditions, has thus far acquitted itself with entire satisfaction. Where traffic is dense, and up to the limits of potential permissible on such a third rail, it has, as now developed, some points of superiority. Of course, where economic conditions require the use of high potentials, some form of elevated construction is necessary. But in this connection, and considering the great cost of the structure shown tonight, it was possible that the last word has been spoken, and there was an alternative possibility which might merit consideration of railway engineers in special cases.

Statements as to the cost of working conductors were misleading. The constant tendency of the times is to require the abolition of grade crossings, and when established in congested districts they can not be changed save at great expense and risk. Even in the country the tendency is to make the clearances as small as possible to avoid unnecessary grades on either the railroad or the street, and when the railroad is the lower, the changes necessary to insure reasonably safe conditions for carrying a high potential a. c. trolley wire by present methods are necessarily costly, and must be added to the capital account chargeable against electrical equipment on this plan. Changes in levels and alignment of tracks, as well as the addition of sidings and running tracks, must also be anticipated.

The requirements of trunk line operation would undoubtedly demand structures of fairly permanent character, for quite apart from the necessity of maintaining operation under all conditions of weather the consequences of even a 10-ft. broken section of trolley wire dangling over a car must be avoided. The cost, therefore, of the working conductor system per mile of road for any given number of tracks will be little changed, even if using high tensions. This fixed unit of cost, while permissible under certain conditions of traffic, is absolutely prohibitive when such is infrequent and irregular, and is quite as serious with permanent overhead work as with third-rail construction, in fact sometimes even more so.

Mr. Sprague called attention to a recently published comparison of costs of the line equipment for two systems; single-phase a. c. operation at 6000 volts, with an overhead line, and third-rail d. c. operation at 600 volts, in which after deducting sub-stations the cost of the former per mile of road on a 4-track line was given as $14,559, while a recent announcement gives the actual cost on the New Haven road as $27,000 per mile, even at 11,000 volts, a part being, it is true, for six tracks, but probably not including the cost of lowering the tracks at Mount Vernon. This is about the cost of two additional tracks on an open right of way, and the question easily arises whether more practical gains would not oftentimes result from such tracks, even if steam operated, than from electric locomotive economy. Of course on some mountain roads additional tracks cannot be added save at enormous expense, and in such cases increase of capacity is possible by some form of electric operation.

Single-phase, polyphase and continuous-current motors have different characteristics. The first gives an intermittent drawbar pull, the others a continuous one. In a 25-cycle single-phase machine, for 50 times a second the torque produced by the reversible and variable current rises from zero to a maximum of nearly half as much as the mean, while in the continuous-current and the polyphase motors the maximum torque is practically the mean for any given conditions. The result is two-fold; first, the latter machines, since they receive a continuous instead of an intermittent delivery of energy, are not only lighter but more economical; and second, for equal drawbar pull it would seem that the actual weight on the drivers of a single-phase locomotive must necessarily be considerably in excess of that required for the others, or else when pushed to the limit there will be a periodic slip.

A comparison of two locomotives appears to bear out this contention. The New York Central d. c. machine has about 70-tons weight on the drivers, its motors measured on the hour rating and without special ventilation aggregate 2200-hp capacity, and it is guaranteed to handle trains having a total weight of from 400 tons to 550 tons, according to the number of stops and schedule required. The New Haven a. c. locomotive is reported to have 72 tons on the drivers, to have an hour rating without ventilation of only 1000 hp, and is intended to handle trains of 200 tons to 250 tons, according to stops and schedule.

It has been popularly stated that while cars equipped with single-phase a. c. motors cannot accelerate as rapidly as those equipped with like capacity of d. c. motors, this is not a matter of importance when dealing with locomotive-drawn trains making infrequent stops. Whatever disadvantage there may be in this respect it is equally present whether a single-phase motor be used under a car or in a locomotive, for in either case it will probably be operated up to the slipping point of the wheels, and the gist of the criticism, of course, is that there is probably required a greater ratio of weight on the drivers to get equal acceleration, and the heating of the motors is more pronounced. This is a matter of considerable importance when attempting the quick accelerations which are necessary for high schedules with frequent station stops, and it is pertinent to operation on the New Haven railroad, where within the district to be operated by single-phase current the station stops and the schedules are practically the same as those of the New York underground railroad, on which d. c. motors are used, and 43 per cent of the weight of the train is carried on the drivers.

Mr. Sprague held that the polyphase motor, admirable a machine as it was, had but limited possibilities in railway service, and was largely confined to single units. For multiple-unit operation it was impracticable under the ordinary conditions of railway operation because of the small air gaps and the difference of duty with varying wheel diameters.

Comparing the direct and single-phase motors simply as machines, he said that the former, with equal development, must always be the better, for it is of simpler construction, is lighter and more economical, has a larger air gap and runs at a slower speed. It has from a half to a sixth as many sets of brushes, can always have a series winding for the armatures, can be operated at a higher individual potential, and sparking at the commutator can be more readily eliminated. Heating is less, for the transformer action is absent, and the torque is constant instead of intermittent. The claim that a motor built for successful operation on single-phase currents must necessarily be the best kind of machine for d. c. operation, was not borne out in theory or in practice. If so there would be no valid excuse for maintaining dual manufacture.

There were, of course, many matters of great technical interest of the utmost importance in the consideration of the complicated problem of electric railway operation on a large scale, but time did not permit reference to them. He had simply tried to hold up to the mirror a few general facts based upon experience acquired in this development, in the hope that some suggestions of value may be formulated and some pitfalls avoided.

Healthy criticism of the defects of any proposition must result in eventual good, and should not be taken as dictated by disbelief in an art to which he had devoted his life or antagonism to any particular development.

CONCLUSION OF DISCUSSION

Mr. Lamme, in closing the discussion, took up first the question of flexibility. He said that the alternating-current system had been arranged to make use of the multiple unit control just as well as the direct current. As regards the rail losses, Mr. Sprague's specific figures were correct, but comparing the 11,000-volt New Haven system with the 600-volt New York Central system he thought that the losses in power would turn out to be the other way. As to draw-bar pull, repeated experiments had demonstrated that there are no essential differences between alternating and direct-current locomotives of the same power.

MEETING OF NEW YORK STATE ASSOCIATION AT ELMIRA

The second quarterly conference under the auspices of the Street Railway Association of the State of New York will be held at the Rathbun House, Elmira, N. Y., on Thursday, March 29. The meeting will convene at 9:30 in the morning and will continue throughout the entire day. A buffet luncheon will be served at noon at the expense of the association.

The conference is to be devoted to discussions and interchange of ideas on transportation topics. For the purpose of starting discussion, the following papers will be presented:

"Interchangeable Mileage Books," by J. H. Pardee, general manager Rochester & Eastern Rapid Railway Company.

"Methods of Discipline," by Julian Du Bois, division superintendent Fonda, Johnstown & Gloversville Railroad Company.

"Advertising," by H. E. Smith, general passenger agent, Hudson Valley Railway Company, and B. E. Wilson, general passenger agent Rochester Railway Company.

"Station Rules," by E. J. Ryon, superintendent Schenectady Railway Company.

A portion of the time will also be devoted to talks on "Collection and Registration of Interurban Fares," and on "City Schedules," and full opportunity will be given for asking and answering questions relative to other transportation topics.

Following the idea as carried out at the first quarterly meeting last February, there will be no entertainments, no exhibits, no supply men and absolutely nothing to detract from a frank and free interchange of ideas on the topics selected.

A cordial invitation to attend the meeting and take part in the discussion is extended by the association to any street railway man interested in transportation matters who desires to come, whether or not he is associated with member companies. The invitation is also intended to apply to representatives of companies in States adjacent to New York State and in Canada.

ANOTHER BIDDER FOR A NEW SUBWAY IN NEW YORK

Frank J. Sprague, of New York, recently announced his readiness to bid upon a new subway in New York provided the operation and equipment of the subway was kept distinct from construction. His offer is contained in the accompanying letter to the chairman of the Rapid Transit Commission:

New York, Feb. 23, 1906.

Alexander E. Orr, Esq., Chairman Rapid Transit Commission, New York City:

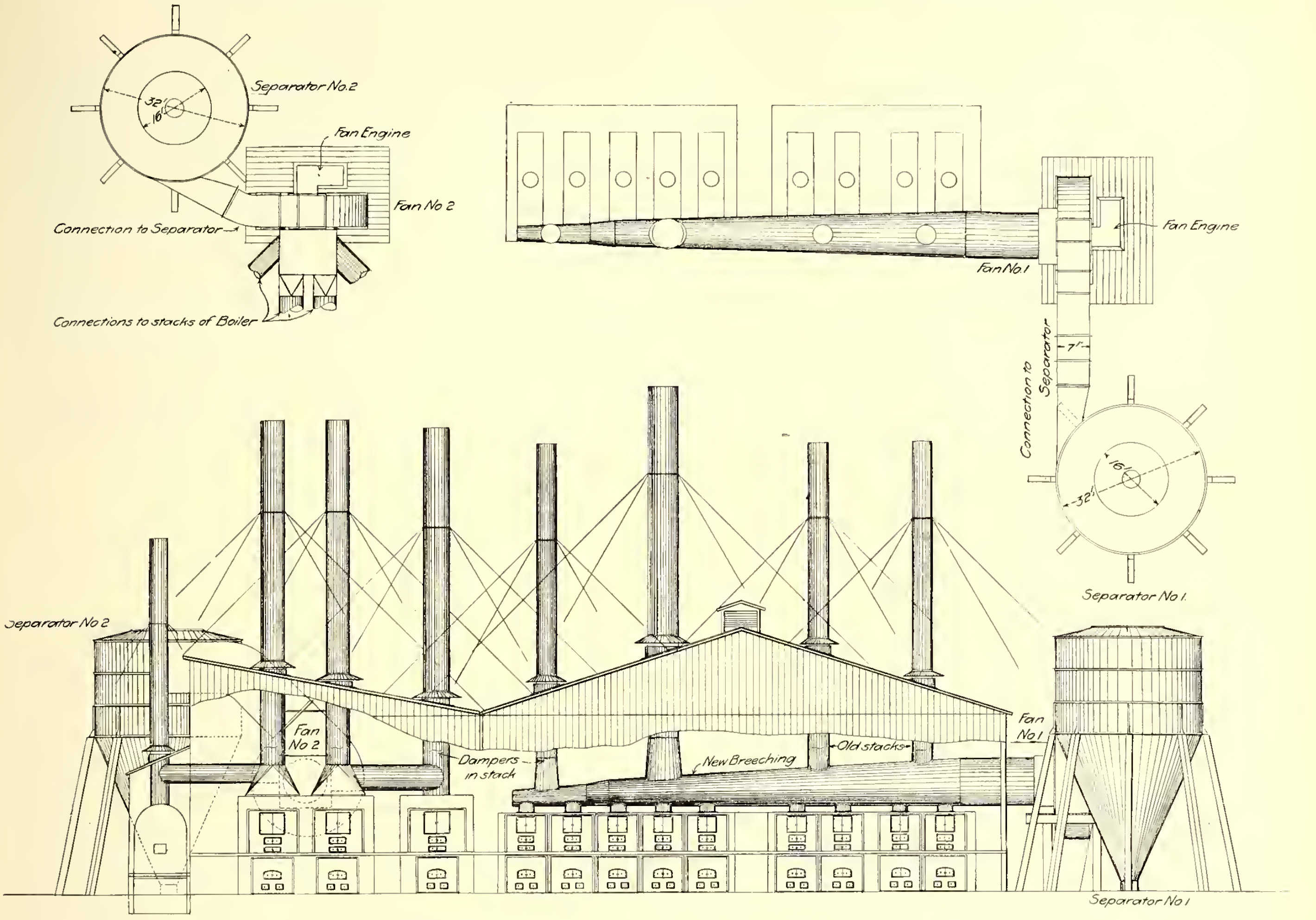
Dear Sir:—Without at present offering any argument on the question of the advisability of separating, on future subways, contracts for equipment and operation from those of construction, I beg to state that if such separation be made, either by virtue of a decision on the part of the Rapid Transit Commission with plenary power, or because of any mandatory provision of new laws, I shall be prepared to bid for equipment and operation of any competitive subway, that is, one not operated as a branch of the existing one, on plans which will insure a maximum carrying capacity and a greater measure of safety in operation.

In this connection I assume that the issuance of specifications will be deferred pending the determination of the present agitation before the Legislature; but prior to such issuance I request the privilege of laying before your board certain essential facts and conclusions relating to the existing equipment and operation, as viewed in the light of contract requirements and results accomplished, to the end that there may be incorporated certain essential requirements beneficial to the city and equally binding upon all bidders. Yours, very truly, Frank J. Sprague.

Since the submission of this proposal it is understood that Mr. Sprague has forwarded to the commission, at its request, the statement referred to in the last paragraph of the above letter.

CINDER-SEPARATING PLANT IN SAWDUST BURNING POWER HOUSE AT PORTLAND, OREGON

To do away with the cinders which constantly belched forth from the stacks of the great power house of the Portland Consolidated Railway Company, which uses saw dust from the neighboring saw-mills as fuel, the company recently decided to have a cinder-separating plant installed by the W. G. McPherson Company, of Portland, Ore. Residents within one-half a mile of the plant had been troubled with cinders collecting on their side walks and porches, and ruining the clothes on their lines. The Inman-Poulsen Company, whose mill adjoins the power plant, is said to have had thousands of dollars' worth of lumber refused by inspectors on account of being blackened by dropping cinders.



GENERAL VIEW AND DETAILS OF CINDER-SEPARATING PLANT OF THE PORTLAND CONSOLIDATED RAILWAY COMPANY

The plant, which cost about $19,000, consists of a great breeching or smoke-box connected to the boiler, at one end of which is an induced draft fan 20 ft. high. By this fan all smoke and cinders from the boilers are drawn through the breeching about 8 ft. in diameter, and forced into immense steel separators of the same form as the shavings separators used by saw mills. A few of the separators is shown in the accompanying illustration.

Due to the action of the fan, the smoke and cinders describe a whirling motion on entrance to the separator. The cinders, being heavy, gradually drop in a spiral path to the bottom of the separator and from that point are conveyed by a steam-driven conveyor to the boiler furnaces, where they are consumed. The smoke, at a comparatively low velocity, escapes through the top of the separators into the open air.

Although the action of the separators has been watched by interested parties using strong field glasses, it has not been possible to perceive the least vestige of cinders in the smoke. While economy in fuel was not the desideratum in making this installation, it has been found that there has been a marked increase in the power developed by the boilers. Another advantage which has been noticed by the operatives of the power plant has been the absolute uniformity of the draft obtained.

5000-VOLT, SINGLE-PHASE RAILWAY IN SWITZERLAND

The Oerlikon Company has just received a contract to equip the Valle-Maggia Railroad from Locarno to Bignasco. The road has a length of 27½ km (about 17 miles). The steepest grade is about 3.3 per cent. The gage will be one meter, and the trains will weigh up to 55 tons. Single-phase current will be used at 5000 volts. The motor cars have four axles with four single-phase motors, each of 40 hp; trailers will also be used for passengers and freight. An available water power will be used and the power house, which will not be very far from the center of the road, will contain two generating sets, each of 350 kv amps.

This railroad will be the second in Switzerland using single-phase current. The first one was the experimental road from Seebach to Wettingen, which was described in the STREET RAILWAY JOURNAL for Feb. 24, and operates at 15,000 volts. The results of this first road have been so satisfactory that the railway department of the Swiss Government has issued a permit for the use of 5000 volts on the Valle-Maggia Railway. This is the highest voltage used so far in Switzerland, with the exception of the experimental road mentioned above.

THE MANAGEMENT AND EQUIPMENT OF RAILWAY AMUSEMENT RESORTS

PARK PLANS OF THE BOSTON, NORTHERN & OLD COLONY STREET RAILWAY COMPANIES

BY H. A. FAULKNER,

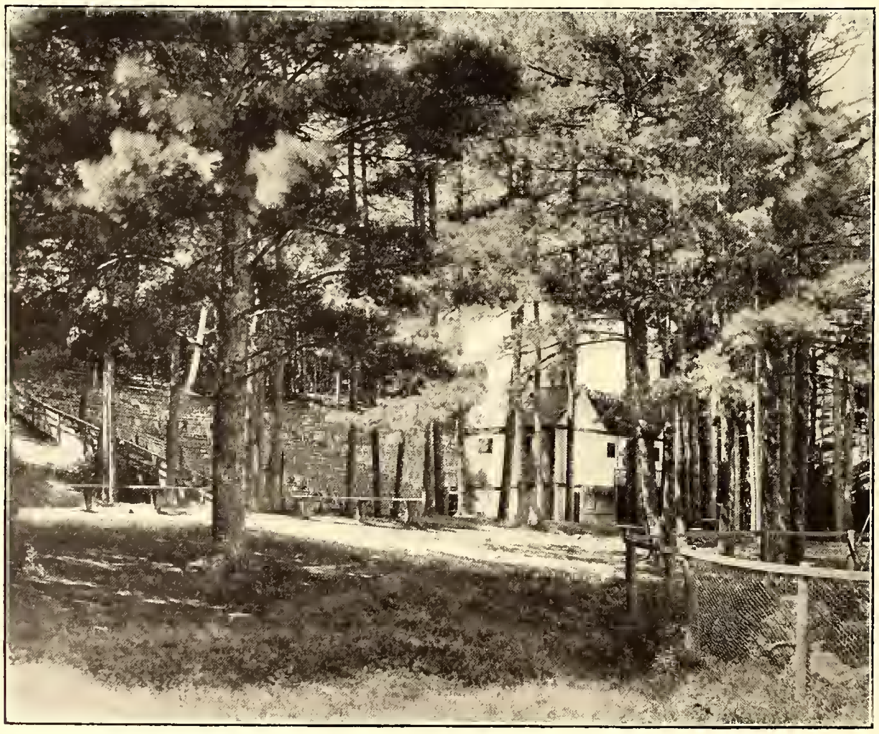
Passenger Agent of the B. & N. St. Ry. Co. and the O. C. St. Ry. Co.

The problem of the conduct of their many parks is being taken up with renewed energy and vigor by the Boston & Northern and Old Colony Street Railway companies this year, as much encouragement was derived from the improvement made in the results last year over those of some of the years previous.

These companies control ten parks on their lines. In seven of these, aside from the usual park attractions there are pretty rustic theaters where performances are given afternoons and evenings through the summer months, with an occasional sprinkling of band concerts and other special attractions. Six of the parks are within a five-cent fare limit of thriving cities.

The seven principal parks are: Sabbatia Park, near Taunton; Highland Park, near Brockton; Lakeview Park, within 30 minutes of Lowell and 45 minutes of Nashua, N. H.; Glen Forest, near Lawrence; The Pines, near Haverhill; Long Beach, near Gloucester, and Westwood Park, near Dedham and an hour's ride from the terminal of the Boston Elevated system. Last year Long Beach and Westwood were leased to other parties to run during the summer, but this year this plan will not be in vogue, but they will be conducted in the regular park circuit.

THE PAVILION AS SEEN FROM ACROSS THE RIVER AT "THE PINES"



THEATER AT "THE PINES," HAVERHILL, MASS.

THE BAND-STAND AT "THE PINES"

Years of experience in the conduct of pleasure parks of this character have taught the management that it is necessary to be liberal, original and varied in its plans from year to year, providing a constant succession of features as widely different from those of the succeeding year as it is possible to do. Last year particularly showed the wisdom of this policy. More money was spent for the attractions and in the general conduct of the parks than ever before and the returns were such as to justify the liberal policy then adopted.

BIRD'S-EYE VIEW OF RAVINIA PARK, OPERATED BY THE CHICAGO & MILWAUKEE ELECTRIC RAILROAD

This year the same policy will be followed, except that it will be even more elaborate in many particulars. The management is not yet in a position to give the details of its summer plans with regard to its parks, but it is planning to be exceedingly liberal in its effort to provide the best possible stage and other attractions, believing that in this way the end will justify the means. During the past winter toboggan slides, artificial skating rinks, log cabins and other facilities for winter enjoyment were introduced in many of the parks, but the weather was such that the benefit from them did not accrue.

THE PICNIC PAVILION AT "THE PINES," HAVERHILL, MASS.

One of the innovations the company will make this year, in line with its policy to provide something new every year, is the introduction of two huge figure-eight roller coasters, among the largest in the country, one at Highland Park, Brockton, and the other at Lakeview Park, Lowell. These are now in the process of construction and will be ready for the summer business.

Negotiations are now being made for the stage attractions and for other special features, and every effort is being made to secure something that will combine novelty with excellence. It is probable that more money will be spent this year than ever before, both in securing attractive entertainment features and in a brisk, constant and energetic campaign of advertising.

RAVINIA PARK, ON THE CHICAGO & MILWAUKEE ELECTRIC RAILROAD

Ravinia Park, one of the two pleasure resorts owned by the Chicago & Milwaukee Electric Railroad, is a distinctive type of electric railway amusement ground. Unlike most of them, it is operated throughout the year and it differs from many in that there are no features intended to appeal to any but the highest class of patrons. The park is located on the railway line about 23 miles from Chicago and 11 miles north of Evanston at a station called Ravinia. It occupies 42 acres of ground, a large part of which is in natural woodland. The whole is enclosed in a high wire fence. One of the illustrations shows the main entrances to the grounds, which consist of attractive gateways on either side of which are shelters for waiting passengers. The reproductions of the buildings show these to be of a construction adapted for winter as well as summer use. The exterior is of gray cement plaster laid on metal lath. Ample provision is made for heating the enclosed buildings in cold weather.

The theater, located near the main gateway, has a roof of steel truss construction which eliminates the necessity of supporting posts at the center and leaves the auditorium free from obstructions. The stage measures 85-ft by 135-ft., and is well equipped with apparatus usually found on the stages of the larger theaters. Every seat in the auditorium, which has a seating capacity of more than 1000, offers an unobstructed view of the stage. Only performances such as appeal to the better class of people are given in the theater, and these include theatrical concerts, lectures and entertainments of a kindred nature. During the winter months a series of entertainments are given at intervals of about two weeks. For two years the Burton-Holmes series of lectures were given. During the present season the Theodore Thomas Orchestra is presenting a series of entertainments. These are given in the evening and special cars are run from Evanston and from points as far north as Waukegan, both before and after the performances. Admission to the theater is by reserved seat ticket only, the charge for this being made in addition to the admission to the park.

The casino contains a cafe, ladies' retiring rooms, men's smoking rooms and lavatories on the first floor and above these a ball room, which is rented for dances to private parties. Last season the Damrosch New York Symphony Orchestra gave two concerts each week throughout the season in the music pavilion. The orchestra at the time contained sixty-five pieces, and on some occasions drew as many as 7500 people. This orchestra will open the park the coming season and will then remain for a period of six weeks, after which music will be rendered by the Thomas Orchestra Company.

MUSIC PAVILION IN RAVINIA PARK

The stadium shown in one of the illustrations is of steel construction, is built to overlook an athletic field upon which base ball and foot ball games and contests of various kinds are held. It has a seating capacity of 2000. In winter a three- acre park and a toboggan slide are the means of attracting large crowds. Attractions of the cheaper variety, such as palm reading, cheap shows, gaming devices, are entirely absent. There is, in fact, nothing at all to attract the undesirable element. The high standard set by the management may be judged from the fact that no intoxicating liquors whatever are sold on the grounds. The admission to the park is 25 cents. In winter a season family ticket, good for ten people, is sold for $5. This gives unlimited use of the skating park and toboggan slide, but does not include admission to the theater.

The park is located between Sheridan and Green Bay roads, two of the prominent drives along the North Shore. These are the means of drawing automobile enthusiasts, and for their convenience two large automobile houses are maintained, and separate entrances for machines are provided. For the coming season the Chicago & North Western Railroad, which passes near the entrance, will put up a passenger station for the accommodation of visitors to the park. Special trains will be run out of Chicago, the road making a special rate of one fare for the round trip.

From the description given of the class of attractions at this successful park, it is plain that even when appealing to such a cosmopolitan city as Chicago, it is unnecessary to stoop to cheap devices to insure good returns.

THE ROLLER-SKATING RINK IN RICHMOND, VA.

BY S. W. HUFF,

General Manager Virginia Passenger & Power Company, Richmond, Va.

It is so often the case that the street railway managers' theory that all park attractions should, at least, sustain themselves and not become a charge against railroad operation, is an exception, rather than the rule, that it is with pleasure that I comply with the request of the editor of the Street Railway Journal to supply a few notes upon the operation of a roller-skating rink.

The Virginia Passenger & Power Company owns a large auditorium located adjacent to the City Reservoir Park, the principal summer pleasure resort of the city of Richmond. The building is about 3 miles from the City Hall. It has a seating capaciy of 3500, and an oval arena of 190 ft. x 70 ft. In this building the Horse Shows are held each fall. Bostock wintered his animals in the building during the winter of 1902-3, and gave performances twice a day. The surrounding park attractions are closed in winter, and it was recognized that a rather strong attraction would be required to draw patronage to this building during the winter season. Two of the principal lines of track of the system terminate at this point; during the summer season, it is the terminus of four through lines of cars, and during the winter season of two, and any travel that might be drawn to the place during the winter is largely velvet, since the winter schedules, already running to this point, take care of the travel.

In the spring of 1905, it was decided to place a sectional reremovable maple skating floor in the arena, and open the building for skating during the summer. It was recognized that the summer in this climate was not ideal for skating, but it was thought that, inasmuch as the people would be attracted by the surrounding out-of-door attractions during the season, that it might be possible to get the sport started so that it would continue through the winter. The result more than realized our expectations. It was found that the skaters created a strong current of air, and that in a high-pitched, well ventilated building, they kept themselves fairly comfortable. The skating started off slowly, and at first was confined almost entirely to men and boys. The management continued to reserve special hours for ladies—although at first but few skated—until at the present time the patronage is about equally divided between the sexes, and the only

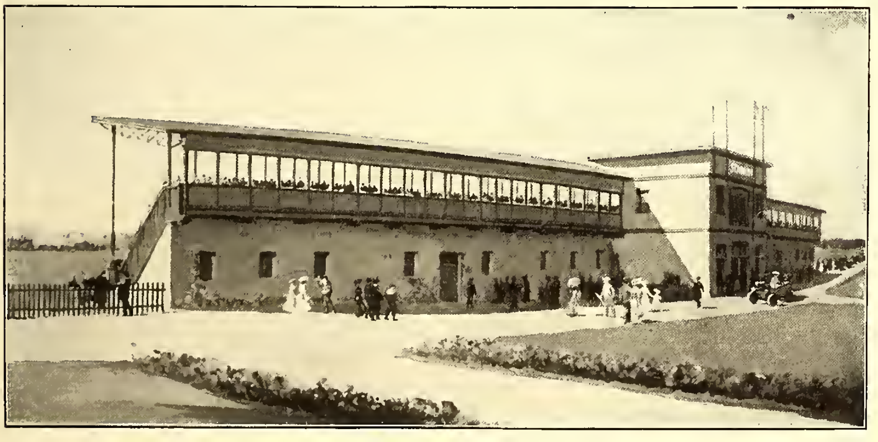
CASINO AND BALL ROOM IN RAVINIA PARK

time now reserved exclusively for ladies is two morning sessions per week.

The company was purchasing a picture machine at the time the skating floor was being installed, and we were anxious to use this in combination with skating. The fact that the skaters required light, and the picture-machine darkness seemed to prevent an irreconcilable conflict between the two. By suspending the arc lights over the arena as low as possible, and hooding them with large hoods, and also screening them underneath with a piece of black cloth, we found that the audience seated in the tiers of seats overlooking the arena could look across above the arc lights and see the moving pictures while, below, the skating floor was brilliantly illuminated by the hooded lamps. The combination entertainment and the nominal charge of five cents admission proved very attractive, and on special nights there are from two to three thousand admissions and from four to five hundred skaters.

Three sessions are held per day—morning, afternoon and evening. Admission is free during the morning and afternoon, and is five cents at night. Ten cents is charged for skates during the morning and afternoon, and in the evening ten cents is charged for the ladies and twenty cents for the gentlemen.

During October, 1905, the floor was removed, and the Horse Show held. Soon after the floor was replaced, it was found that the sprinkling of the ground in preparation for the Horse Show resulted in a dampness that was curling the individual boards of the floor. This became so bad that it was necessary to lay a second floor over the top of the first floor. The second floor was laid by building it up in sections 4 ft. x 30 ft., and tongueing and grooving the ends of the sections as well as the sides, and screwing the sections together and to the old floor through the battings upon which they were built. This has proved a very satisfactory floor, and the patronage has been well sustained during the winter. The receipts average $137 per day—approximately one-half of which is from admissions. With the above average receipts from the nominal charges indicated, the winter travel added to the car lines can be appreciated.



THE RAVINIA PARK STADIUM FOR OUTDOOR SPORTS

During the summer, various types of bands were used with more or less success. The principal trouble was to get one that could be heard above the continual thumping upon the floor by learners. A fife and drum corp were finally used with some success. During the winter, an Italian band of ten pieces has rendered very satisfactory music, and an expert skater has given daily exhibitions and has instructed learners.

There is every indication that the attraction will prove a success during the coming summer; I question, however, whether it will last much longer.

We have not found the skating rink, taken as a whole, a very easy proposition to operate. It has been under the supervision of our superintendent of transportation, C. B. Buchanan, who has shown great skill in stimulating the sport by attractive events without overbooming it. It has been under the immediate charge of our special police officer, James E. Eubank, who has handled the mixed crowds with firmness and tact. From the beginning, the public was given to understand that disorder or rude conduct would not be tolerated for a moment, and that no favoritism would be shown in this particular.

RAVINIA THEATER, OPERATED BY THE CHICAGO & MILWAUKEE ELECTRIC RAILROAD

In planning for our skating rink, we were very much indebted for advice to W. O. Hay, secretary of the Northampton Traction Company, Easton, Pa., who was operating a rink on his line, and, if our experience will enable us to be of any service to others, we shall be very glad to pass the advice along and give any information we can to parties intending to open a rink.

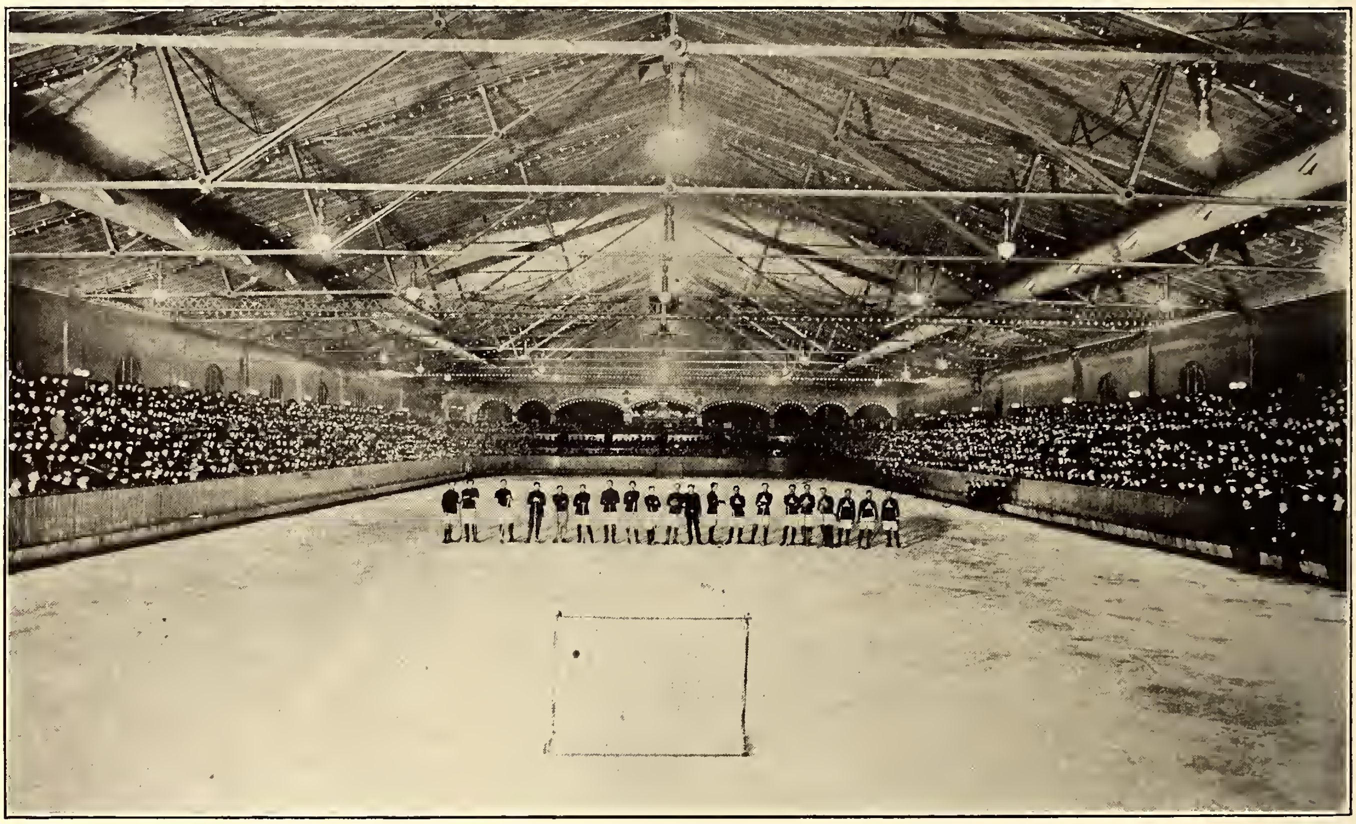
DUQUESNE GARDEN, PITTSBURG

BY A. S. McSWIGAN,
Manager of Amusements and Advertising, Pittsburg Railways Company

Ice skating as a feeder for street railway traffic has developed to a fine art in Pittsburg. Railroad managers everywhere have recognized that ice and roller rinks—if large enough—are good boosters for receipts, but nowhere outside of Pittsburg has a traction company gone into the business so extensively. There the Pittsburg Railways Company owns and operates Duquesne Garden, the largest artificial ice skating rink in the world. It is a unique institution, and is worthy of consideration by street railway managers elsewhere.

Duquesne Garden is known almost everywhere, even in Europe, which continent has many artificial ice rinks. It was originally the car house of the Duquesne Traction Company, and was abandoned after several years' use by reason of the consolidation of the Duquesne, Pittsburg and other traction properties. In 1898, while negotiations to sell the building were under way, the Pittsburg Casino, a handsomely appointed artificial ice skating rink, was burned. Some of the owners of the Casino—among them the late C. L. Magee and former Senator Wm. Flinn—were large stockholders and officers of the consolidated traction properties. Looking around for a site on which to rebuild the Casino, they decided the car house of the old Duquesne Company was suitable. It is a brick and stone building two stories high, fronting 140 ft. on Craig Street, with a depth of 400 ft. along Ellsworth Avenue to Neville Street. A force of men was put to work, changes and alterations were made in the interior, a refrigerating plant was installed, the engines being machines moved from an abandoned railway power plant, and the place was opened for ice skating Jan. 23, 1899. It has been lessees gave notice that they would not renew the garden lease, which ran until October of that year. James D. Callery, president of the Railways Company, did not want the building to stand idle and, the lessees not caring to continue, decided to operate it. The writer was sent out from the city office to run it and has been running it ever since.

The Garden is right in the heart of Pittsburg, being midway downtown and the East End residence section. All the Fifth Avenue, Forbes Street and Center Avenue trunk line routes either pass the doors or are within a couple of minutes' walk. The entrance is on Craig Street, and is protected by a wide, heavy glass shelter built over the sidewalk. On each side of the spacious tiled foyer are the ticket sellers' windows. Three double plate glass doors separate the lobby from the inside of the house. On the left as one enters is a skate and coat room where private skates, coats, hats, etc., are checked for patrons. Beyond the coat room is a ladies' parlor—



A HOCKEY TEAM PREPARING FOR A CONTEST IN DUQUESNE GARDEN, PITTSBURG

in continuous operation ever since. The Pittsburg Railways Company operates Duquesne Garden through the Duquesne Garden Company, which is one of the underlying corporation, the capital stock of which is either owned by the Railways Company or the Philadelphia Company, the latter being the holding company of all the separate corporations. The officers of the Duquesne Garden Company are the same as for the railways, namely: President, James D. Callery; vice-president, James H. Reed; secretary, W. B. Carson; treasurer, C. J. Braun, Jr., and auditor, C. S. Mitchell. The writer is the manager of amusements, his work covering the company parks as well as the garden. There is no outside organization connected with the garden now. Prior to the Pittsburg Railways Company taking possession in 1902, the garden had been leased by the Consolidated Traction Company, which controlled it, to an operating company. Officers of the Consolidated Company were interested in the operating company. When the garden came to the Pittsburg Railways Company with the Consolidated Traction Company, on Jan. 1, 1902, the 25 ft. x 49 ft.—carpeted and elegantly furnished with upholstered chairs, etc. Off the main parlor is an inside parlor or retiring room with large toilet room and women's comfort necessaries. There is also a separate women's check room, where skates and wraps are checked. On the left as one leaves the parlors is the ladies' skate counter where patrons who have no skates can secure "house" skates. No charge is made at the Garden for checking privileges or use of skates, both being included in the price of admission. A pleasing feature of the ice skating business is that nearly all the patrons have their own skates with shoes attached, there being little call now for house skates. This is different from roller rinks, which have to invest considerable money in skate equipment.

The inner lobby is 45 ft. x 109 ft., the floor being laid with heavy imported linoleum. Experience has shown it to be the best floor covering. It wears well despite the popular belief that it would be cut up by skates as patrons go on or come from the ice. In the center is a beautiful circular soda fountain around which thirty-five people can sit at one time. To the right of the entrance is a large luxurious smoking room—36 ft. x 48 ft.—with large leather arm chairs, round seats, etc., a large lounging place where even a poor cigar seems enjoyable. Off the smoking room are the gentlemen's toilet rooms—tiled and with marble-cased urinals, closets, etc. At the extreme right of the lobby is the gentlemen's skate counter. The building is lighted with 40 alternating arc lamps and 3000 16-cp incandescent lamps.

The ice rink or skating surface is 90 ft. wide x 260 ft. long; nine times around it giving about a mile. It is about 6 ft. below the floor level of the building, accesss to it being by four wide stairways, two on each side, leading down from a promenade. At the edge of the ice and running all the way around the rink is a seat on which skaters can rest. Back of this seat are boxes and seats for spectators running all the way around the ice. Behind the seats and between a railing and the wall is a 6-ft. promenade on both sides, which runs the full length of the building. There are 1604 seats. The promenade and lobby from which spectators can look down on the ice give standing room to 3000 more people, and on big nights this capacity is taxed.

The ice-making machinery is at the Neville Street end of the building, there being two 45-ton ice machines driven by electric current taken from the trolley feed lines. The ammonia cold brine system is used. There are over 18 miles of 1 in. pipe laid as closely together as the fittings allow. These pipes rest on a waterproof floor or pan. To make the ice at the beginning of the season—about Nov. 20—water is poured on the floor from lines of fire hose. It fills in and around the pipes which have previously been made cold by the circulation of cold brine. As the water comes into contact with the lays alongside the pipes, the refrigerators draw out the heat and the water, of course, freezes. More water is added until the pipes are covered to a depth of a quarter or half an inch. When this water freezes the ice is ready for skaters. The under ice remains firm all season. After each night session three men and a horse draw a steel scraper over it, scraping and leveling it off. Three or four times a week the top of the ice is flooded with water and a new smooth skating surface is made. During the season the ice is from 1 in. to 2½ ins. in thickness. Current for running the machinery is taken from the railways company circuits, but steam is preferable to electricity. Since the Garden plant was installed it has been found that the mechanical end can be so arranged that ice for skating can be made in winter and the same machines can produce ice for the trade in summer. This ice can be sold for $2.00 a ton or more. Thus the machinery which will ordinarily stand idle when the skating rink is closed, can be made not only to pay some return on the investment but will clear a profit. And this summer ice business could be carried on without interfering with the rink part of the building, which can be used for dancing or other purposes during the non-skating season.

The skating season opens at Duquesne Garden the middle of November and generally continues until the first or middle of April. At its conclusion the ice is allowed to melt and a sectional wooden floor laid on top of the pipes. This change can be made in two days and the building is then ready for exhibitions, large receptions, etc. The total admissions in a skating season will run from 175,000 to 200,000, of which fully 80 per cent ride on the cars, paying at least 10 cents. As the Garden is self-supporting this haul is "velvet" for the company. The admission prices range from 10c. on Saturday morning for children, to 50c. for adults, with $1 for seats on special nights.

After the close of the first skating season the interior was changed into a summer theater with beautiful palm garden etc. Light vaudeville and musical comedy was put on and transfers from the street cars accepted for admission. This was found non-profitable and was discontinued. The next season good standard popular opera was offered and was continued each summer until two years ago, when on account of many summer parks it was found to be more profitable merely to put down a floor and rent the place for exhibitions, receptions, etc. The first exhibition this spring will be the annual Pittsburg dog show, which will be held the week of April 2d.

In connection with skating the most profitable feature has been found to be the Canadian winter game of hockey. This is an evolution of the old-fashioned "shinny" and is played with seven men on each team. The positions are known as goal, point, cover point, center, rover, right wing and left wing. The playing field or ice surface must be 150 ft. long x 50 ft. wide. The players use sticks 4 ft. long with a 3 in. wide curved base. With these they push or move the puck—a hard rubber disk—which is 3 ins. in diameter and 1 in. thick—over the ice, passing it back and forth from one player to another, the object being to shoot it into the opponents' goal or net. The latter stands at the edge of the playing field and is 6 ft. x 4 ft. high. The game was introduced in Pittsburg, by Canadians living there, in the old Casino, and has proved to be very popular. It requires strength, skill and speed, and for thrilling, heart-pulsating interest there is little like it in American sports. From playing amateur scrub games it has progressed until now there is a regularly organized professional league playing championship matches. Over 5000 people have attended some of the games. By next winter it is expected to have a league composed of Pittsburg and other cities. The success of Duquesne Garden has awakened capitalists in Philadelphia, Boston, Chicago, Cleveland, Toronto and Louisville and plans are now under way to build artificial ice rinks where hockey can be featured in those cities. The only other cities that have artificial ice rinks at present are New York, Brooklyn and New Orleans. So many letters have been received from people all over the country regarding cost of construction, operation, etc., that the management has compiled considerable practical data which can be had by other street railway companies or others who contemplate going into the business.

Other features of the ice skating business are races, carnivals, etc. The annual National Indoor Amateur Championship Races are held at the Garden in February, and draw over 4000 people each night. Fast speed skaters from all over the country compete.

The Garden is operated by the Duquesne Garden Company, the executive officers of which are the same as the Pittsburg Railways Company, James D. Callery being president. The management is part of the amusement and advertising department, of which the writer is the manager. In addition to the Garden the railways company owns or operates Kennywood Park, Calhoun Park, Southern Park, Oakwood Park, Junction Park and Morado Parks. All of these are good feeders for the trolley cars and create a vast traffic.

DUQUESNE GARDEN SCALE OF PRICES

General admission for evening hockey games	50c.
General admission on evenings when no hockey games are played	35c.
Admission morning and afternoons	25c.
Children under twelve years	15c.

Children charged full price all evening sessions.

Book tickets, 20 coupons in book $5.00

Good at all public sessions, except big hockey games, when two coupons will be accepted for one admission.

Garden can be rented for hockey games and private parties—10 to 12 a. m—fifty persons or less, $25.

Special school children's matinee each Saturday morning, 9:15 to 11:45 a. m. .... 10c.
Special hockey session Saturday mornings, 7:15 to 9, open to all boys .... 25c.
Boys may remain for skating session, 9:15 to 11:45 a. m.
Holiday afternoons .... 35c.

THE CONSTRUCTION AND OPERATION OF PENNY ARCADES FOR SERVICE IN RAILWAY PARKS

The notice on penny arcades, which was published in the STREET RAILWAY JOURNAL of Feb. 24, as part of the article entitled "The Management and Equipment of Pleasure Resorts," brought a call for further information on this subject from a number of railway companies considering installations of this character. In this connection, the practice of a company which confines itself exclusively to penny arcade work, may offer some valuable hints to others. The Diamond Novelty Company (Inc.), is a coin-operating corporation with headquarters in Syracuse, N. Y., and additional arcades in the nearby towns of Auburn, Watertown and Schenectady. Aside from operating arcades, the company makes a specialty of fitting them up for operation by others. The machines required for an up-to-date arcade are too varied in number for manufacture by any one concern, but it might be mentioned that this company manufactures machines for fortune telling, postal cards and perfume.

While coin-operating machines, or slot machines, are not a recent invention, the application of their use for purposes of amusement and physical development dates back less than ten years. The first coin-operating machines to come into public notice were mostly gambling machines of various descriptions, which, in due course of time, came under the ban of the law. In later years, when legitimate automatic, coin-operating machines began to appear in public places, the prejudice against gambling devices naturally asserted itself against any machine classed as a slot machine.

The rapid strides made during the past fifteen or twenty years in labor-saving devices, has not only had its effect upon the manufacturing world, in lessening the cost of production, but has also made it possible to vend goods automatically, due to the development of coin-operating machines, and in a very large measure counteracted public opinion prejudiced to slot machines.

The first penny arcade established was looked upon as an immoral resort; however, the fact that this arcade is still in existence is sufficient evidence of the stability of the institution, and the education of the public.

At first, a large number of the machines exhibited in arcades were operated with a nickel, but nickel machines did not appeal to the public when assembled, and the experience of operators during the past seven or eight years, has conclusively proven that a "penny a look" is not only the most popular for the public, but also the most profitable to the investor.

As a rule, penny arcades are not profitable in cities of less than one hundred thousand population, or in summer amusement parks where there is not a fair daily attendance of visitors.

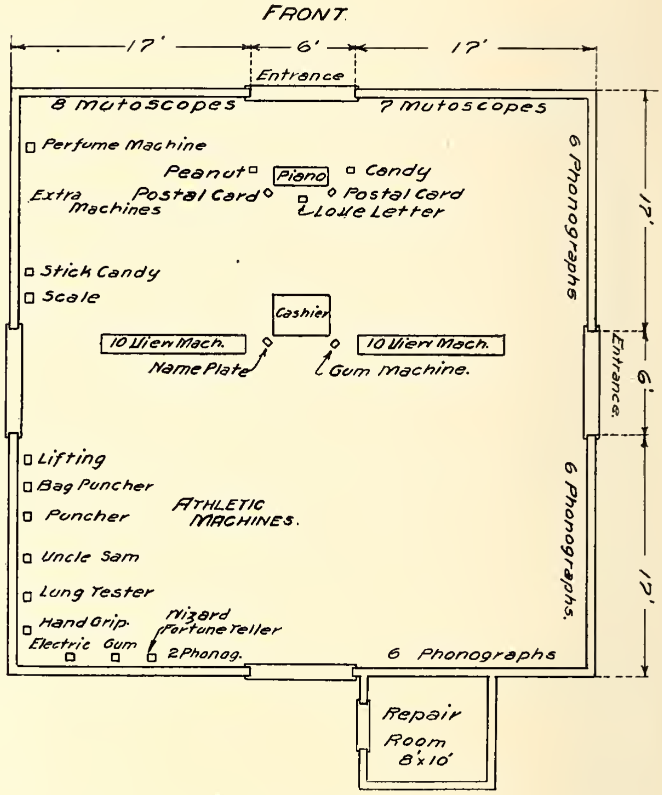
In starting an arcade, the first consideration must be location.

The public will not go out of its way to spend a penny and, therefore, the arcade must be located where the largest number congregate or pass. Without good location, an arcade will not prove profitable. After a proper place is secured, good judgment and care must be exercised in fitting up the arcade, which should be attractive, clean and well lighted. The arrangement of machines is in a measure a matter of taste, and depends upon the shape of the arcade and the number of machines to be placed.

It is customary to place mutoscopes, or life motion, machines and phonographs in a prominent position, arranging view-picture machines and machines of a miscellaneous nature, in such a manner that patrons may pass without interfering with others who may be operating machines.

The cashier should be located near the center of arcade, in an artistic cashier's box, and must be provided with pennies for change. As machines will get out of order occasionally, it is necessary to employ a person with mechanical ability to make necessary repairs.

For park purposes, a building 40 ft. square is desirable. It should be sufficiently open to admit of a free circulation of air, and in the style of a pagoda or pavilion. Entrances



PLAN OF A TYPICAL PENNY ARCADE FOR SERVICE IN A PARK

should be provided on all sides. A building of this nature can be constructed for $500 and upwards. The expense of wiring for lights and machines should not exceed $200, and floor would accommodate from 125 to 150 machines.

The building above described, equipped with an assortment of 75 machines, wired up and ready for business would represent an outlay of approximately $4,500, and can be operated at a cost of about $60 per week, including the electric current which is necessary for the operation of a first-class arcade.

In conclusion, having given a brief description of the inception and operation of the penny-arcade idea, it cannot be too strongly impressed upon the minds of possible investors, the necessity of proper policeing the arcade, and displaying nothing of an offensive nature to the severest critic.

Everything must be absolutely clean and inoffensive in order to attract the intelligent and reputable public. The exhibition of vulgar attractions or catering to degenerates, means financial suicide. The rule should be: "Display that only which is proper for any child to see or hear, for where the women and children go, the men will surely follow."

PENNY ARCADE EQUIPMENT

Street railway and park managers are often loath to undertake the establishment of a penny arcade because they realize that they know little or nothing about the business. However, the firms who make a special business of such amusement features will give all desired information. These usually manufacture or deal in the machines, and on receipt of sufficient information from the railway manager regarding the location and attendance at the park, will outline the kind of establishment required, the kind of machines that have been found to pay best and, in fact, will furnish prices for the whole outfit installed ready for operation. It is always to the interest of these firms to be governed by the actual needs of the location rather than by the money they will obtain from the original purchases of the investor. They realize that if they overstock the purchaser in the beginning the investment may prove a failure. On the other hand an investment proportioned to actual needs means a success and more sales in the future. A firm manufacturing penny amusement features which has had years of experience in the amusement business is the Mills Novelty Company, of Chicago. This company undertakes the whole burden of establishing arcades and putting them in operation. It furnishes the machines, the interior decorations, advertising devices, and everything else required. It is the company's custom to send an experienced man to set up all the apparatus properly and to stay with the establishment until the pennies have begun to come in.

For the "Penny Vaudeville" business the National Phonograph Company, of Orange, N. J., manufactures the Edison coin-slot phonographs. The number of records is almost without limit, and for a very small investment the management can secure the strongest and most lasting of low-priced attractions, varied to suit the taste of all classes of patrons.

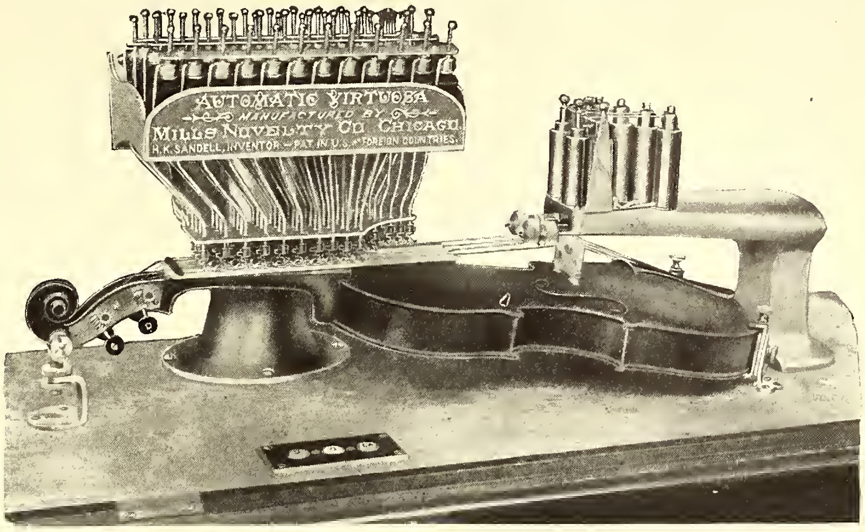
ONE OF THE VIEWS TAKEN TO PRODUCE "ESCAPED FROM SING SING"

AUTOMATIC PIANOS AND ORGANS

In connection with the equipment of penny arcades, the automatic piano has become an indispensable feature, as it is an attraction in itself besides acting as a good advertisement of the presence of an arcade. Instruments of this character are imported from Paris by Cavioli & Company, of New York, who are also prepared to furnish a large variety of Parisian-made cylinder and cardboard organs suitable for merry-go-rounds and show halls.

MOVING PICTURES

Whoever has given any thought to the development of moving pictures as an entertainment must have marveled at the realistic representation of life and scenery. It is a fact that some of the "star" films have cost thousands of dollars, the cost for the photographic material forming but a fraction of the total. An example of the elaborate means required is that of the subject entitled "Escaped from Sing Sing," originated by the Vitagraph Company of America. The prisoners are represented as escaping from the prison to the open country, and being thoroughly modern, they capture an automobile. The pursuing keepers, not to be outdone, secure a second machine, and upon coming up to the refugees, enter into a desperate battle. At last the struggle ends tragically in the home of one of the prisoners. For this series of pictures a large number of men are required, in addition to special scenery, two automobiles, etc. As the public demands a realistic performance, the people employed for part of the story are trained actors and actresses, and must be paid accordingly. The Vitagraph Company of America, which has its headquarters in New York, has brought out a large number of attractive subjects, the films of which it will either rent or sell outright to park managements. It does not sell its machines, however, only leasing them for stated periods.



SELF-PLAYING VIOLIN FOR PENNY ARCADES

Among the firms making a business of originating moving-picture subjects may also be mentioned the Twentieth Century Optiscope Company, of Chicago. This company has developed an extensive assortment of attractive pictures for park use, and will furnish a weekly change of all the latest headlines on a rental basis, with or without operators and machines.

SPIRAL TOWER EXHIBITION

One of the strongest and enduring traits in human nature is that manifested for witnessing feats of physical skill and daring. Few entertainments of this character are as picturesque, however, as the spiral tower exhibition which is carried out by Lionel Legare, of Bethlehem, Pa. This act has proved an excellent open-air attraction in a great many parks and is made especially effective at night by the addition of fireworks and electrical effects.

MISCELLANEOUS PARK ATTRACTIONS

C. P. Parker, of Abilene, Kan., is not only a manufacturer of a great variety of amusement devices, but has also originated a number of spectacular shows. Among his manufactures are merry-go-rounds, mechanical shooting galleries, jumping horses, etc. The elaborate attractions ready for the coming season include "North America," a massive historical spectacle and "Beautiful Bagdad."

HANLON POINT PARK, TORONTO, ONT.

ROLLER COASTERS

Probably no line of business has come into greater prominence within the same space of time than the railway amusement park. Among the first to discover the opportunities in this line of business was the Ingersoll Construction Company, of Pittsburg, Pa. Beginning in a small way some ten years ago, its business has increased until its name has become widely known to every street railway company throughout the United States, Canada and other countries. This company contracts to build practically every known amusement, its leading feature, however, being the "Figure Eight" roller coaster. In this attraction it has developed features entirely unknown to other makes, its safety appliances playing a prominent part in the mechanism of the machine. This feature must appeal strongly to street railway companies, whose solicitude for the safety of their patrons is most pronounced, and especially in view of their experiences with transportation accidents.

During the existence of this company it has built and equipped fifty-three "Figure Eight" coasters, thirty-six of which it owns and operates in street railway parks, paying to the railway company a percentage of the gross receipts for ground space. From Boston to Chattanooga, in Canada, through the Central States to Los Angeles, along the Pacific Coast as far north as Seattle, in nearly all the prominent pleasure parks throughout the country, may be found amusement devices built and equipped by this company. Seattle is the scene of the company's latest venture, where an amusement resort covering about 20 acres and to cost more than $400,000, is nearing completion.

The marvelous success of this firm may be summed up in the following statement by E. E. Gregg, its president and general manager: "Park amusements to be popular with the masses and consequently profitable for the operator, must possess three requisites, viz., novelty, excitement and safety. You must give park patrons their money's worth and more too. Fake schemes and bunco games have no place in a well-regulated resort. It has always been my aim to provide nothing but clean, wholesome amusements, and our "Figure Eight" comes nearer to this than any other feature I have ever found. It never gets old, and the demand this season is greater than ever before."

SPRINGBROOK PARK, SOUTH BEND, IND.

Mr. Gregg has held his present offices since the Ingersoll Construction Company's organization. He is a well-known figure in the amusement field, and his opinion as to the merits of new attractions is solicited by many inventors and promoters. The two views on this page are of parks furnished with this company's roller coasters.

THE VOYAGE OF NOAH

Walter S. Kelley, of New York, who is widely known in the Mardi-Gras, park and carnival world as an originator of twentieth century features, offers this season an electric scenic production, entitled "The Voyage of Noah." It is a spectacle intended to carry the amusement seekers to the time of Noah himself. This illusion first permits the eye to penetrate through the pale moonlight beaming upon the land of Nod, which was situated East of Eden, and at a place overlooking Enoch, the city built by Cain. In this scene the city is shown illuminated. The lights are gradually extinguished, the moon is hidden behind the mountain and nothing but the

THE SACRIFICIAL OFFERING AFTER THE STRANDING OF THE ARK

stars remain visible. A golden dawn then breaks over the beautiful tropical land, showing once more the world of wickedness. At last, warning is given, but no heed is taken. When the day of vengeance arrives, Noah and his family, who had believed, safely lodge themselves in the Ark, after which the deluge of water and fire comes, sweeping away everything in its path to total destruction. The Ark, having safely landed on Mt. Ararat, Noah, his family and all the other living creatures disembark. Noah offers a lamb without blemish as a sacrifice for his deliverance, and a rainbow appears in the sky, as a sign of the covenant.

A NOTED PAIR OF DIVING HORSES

The high intelligence of horses and their willingness to obey man has made them rather common as trick performers, but it is certainly unusual to find a pair of these animals indulging in high-diving performances on their own volition. Some years ago, J. W. Gorman, the Boston amusement purveyor, learned of the existence of a pair of young horses which possessed this remarkable trait. Recognizing the high exhibition value of such an act, he finally succeeded in purchasing them for park performances. The animals, which are brother and sister, are named respectively King and Queen. They are pure white in color, and are said to be of Arabian descent. It appears that they were never taught to dive, but that trait is hereditary with them. Since coming into Mr. Gorman's possession they have proved to be among the most attractive features at hundreds of parks and fairs in America and Europe.

When ready to perform, both animals are brought to the foot of a long incline leading to a platform in mid-air. King very courteously permits Queen to precede him for the diving act. Upon reaching the platform, the mare places her fore feet on a little shelf below the platform and, lowering her head, springs outward and downward, diving 40 ft. through the air into a shallow lake. As soon as the mare has left the water, her partner repeats the act. Although neither of these animals has been "educated," in the usual sense of the word, they show a high degree of intelligence, and their evident pleasure in diving is not the least interesting part of their remarkable performance.

RECENT CAR HOUSE FIRE IN NEW YORK

Additional particulars are available concerning the destruction by fire on Sunday, March 4, 1906, of the West Forty-Second Street car house, owned by the New York City Railway, brief announcement of which was made in a recent issue of the Street Railway Journal.

The house, which was formerly a horse car barn, occupied a portion of the block fronting on the Hudson River, between Forty-Second Street and Forty-Third Street. The building was a three-story structure with brick walls and light joists. The ground floor was wood and the pits under all the tracks had

VIEW SHOWING ALL THAT REMAINED OF THE NEW YORK CITY RAILWAY CAR HOUSE AFTER THE FIRE, NAMELY, THE THREE-STORY OFFICE SECTION AND A PORTION OF THE WALLS

wooden floors with wooden flooring between tracks. The building was totally destroyed, with the exception of a three-story office section on the Forty-Second Street side, which had recently been partially rebuilt with fire proof materials. This section, however, was badly damaged and will probably have to be rebuilt.

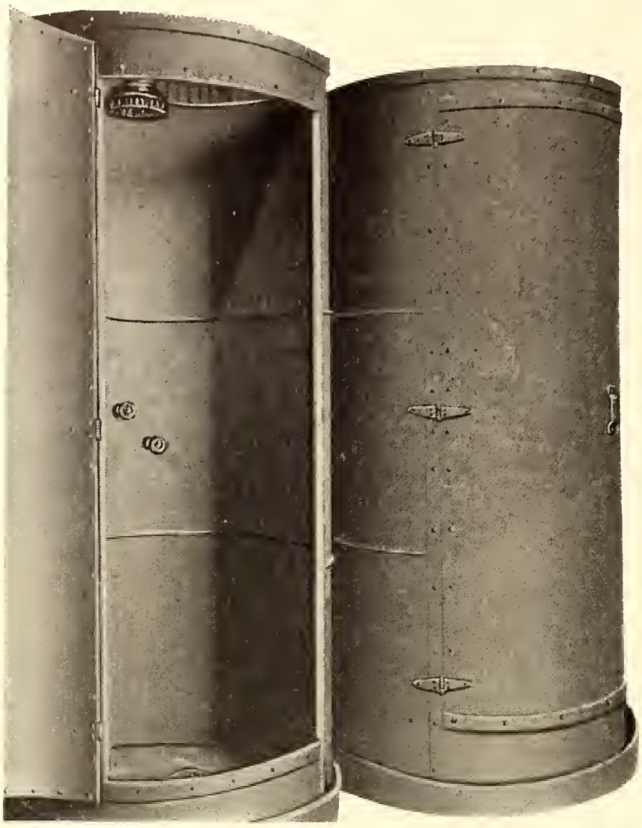
The fire started at 7:45 p. m. in a car which was over one of the repair pits on the most westerly track, about 100 ft. back in the house. Arrangements were being perfected to run the car out when the shoe, or plow, which makes contact with the underground conductors, in some way short circuited the two conductors, causing a blaze. The arc occasioned by this short circuit immediately set fire to the car.

It is asserted that not over a five-minute delay was occasioned between the time of the discovery of the fire and the giving of the alarm.

The firemen arrived almost immediately after the alarm was sounded, but were afraid to go into the building until assured that all current was turned off. This delayed somewhat the application of the water, and practically all the firemen were able to do was to save the complete destruction of the three-story office section.

SHOWER BATHS FOR THE MEN

The Galveston Electric Company, of Galveston, Tex., of which H. S. Cooper is general manager, has recently installed a number of shower baths at one of its older car houses. Details of these baths are here given as suggestive to other companies whose buildings are not equipped with baths and who may not feel warranted in spending a considerable amount of money in installing elaborate bathing facilities.



TYPE OF SHOWER-BATH OUTFIT USED IN GALVESTON, TEX.

Each bath consists of a casing of galvanized iron bent to form, as indicated in the engraving. The casing is designed to set in a tray which drains into an outlet pipe and each bath has an overhead spray with hot and cold water supply. The cost of making and installing the baths was insignificant, and the company considers the expenditure one of the best investments it ever made, as the majority of the men make regular use of the facilities thus provided.

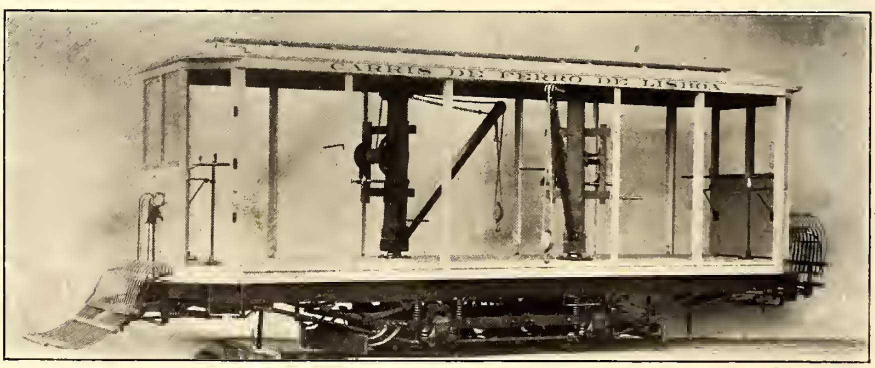
SHALLOW SUBWAY OPENED IN LONDON

The tramways committee of the London County Council has just opened for service the first shallow subway line in London. It extends from Aldwych to the "Angel," Islington, and has side galleries for pipes and wires. The greater portion is close to the street surface, but in the short length of less than a mile between Theobald's Road and the Strand, there are several kinds of construction. The rails are on the surface in Theobald's Road, and then descend below the surface in Southampton Row by an open cut, after which its distance from the surface (roof to street level) varies from 3 ft. to 33 ft. Both of the stations—one at Great Queen Street and the other at the Kingsway—Aldwych junction—are only 16 ft. below the street. The subway is built with steel girders and is faced with white bricks throughout. Incandescent lamps are used for its illumination.

The rolling stock is of the single-deck type, constructed of non-inflammable material throughout. The first lot of sixteen was built by Dick, Kerr & Company, after the designs of A. L. C. Fell, the manager of the tramways. The principal dimensions are: Length over all, 33 ft. 6 ins.; width over all, 6 ft. 10 ins.; height, 10 ft. 11¼ ins.; and length of the platforms, 3 ft. 8½ ins. The cars seat thirty-six passengers each. The main floor is constructed of rolled steel angle and channel bars, with steel knees and gussets. The side posts are built up of two channel bars placed back to back, supporting the angle steel cant rail and the steel car lines. The roofing is of mild steel plate. The interior finish consists of aluminum sheet panels and mouldings. The floor is made up of steel plates covered with fireproof material. The seats, which run longitudinally, are built up of oak slats fixed to angle-steel supports. All woodwork is treated with a fireproofing compound. The trucks are of the maximum traction type, carry 39-hp motors, and have steel-tired wheels. In addition to the hand brake, electromagnetic track brakes have also been installed. The Callender cables used are carried in steel castings.

CONSTRUCTION CAR FOR LISBON

The interesting type of construction car shown in the illustration was recently shipped to the Electric Tramway Company of Lisbon, Portugal, by the J. G. Brill Company. An article in the STREET RAILWAY JOURNAL of Jan. 27 last, described a shipment of twenty Brill semi-convertible cars for use by the same company. The car illustrated is powerfully constructed and has heavy sub-sills and the posts which support the roof are composed of angle-irons which are bent to conform to the shape of the roof. This post arrangement gives ample strength for the support of the two cranes, which are to be used for loading heavy pieces of material, such as wheels, axles, rails, etc., on the car or on a car alongside.

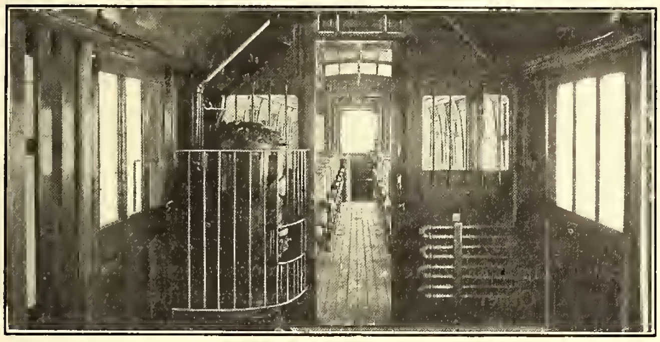


CONSTRUCTION CAR FOR USE IN LISBON, PORTUGAL

Each crane is capable of lifting one ton. The cranes are of a simple type operated by two cranks. The car is mounted on the builder's No. 21-E truck, which is equipped with track brakes as well as the ordinary form of brakes. The horizontal hand wheel shown at either end of the car, operates the track brakes. The length of the car measured over the body is 25 ft., and the width over the posts, 8 ft. The truck is equipped with two 37-hp motors. The gongs, angle-iron bumpers and other specialties used on this car are of the builder's manufacture.

NEW EQUIPMENT FOR THE TIFFIN, FOSTORIA & EASTERN RAILWAY

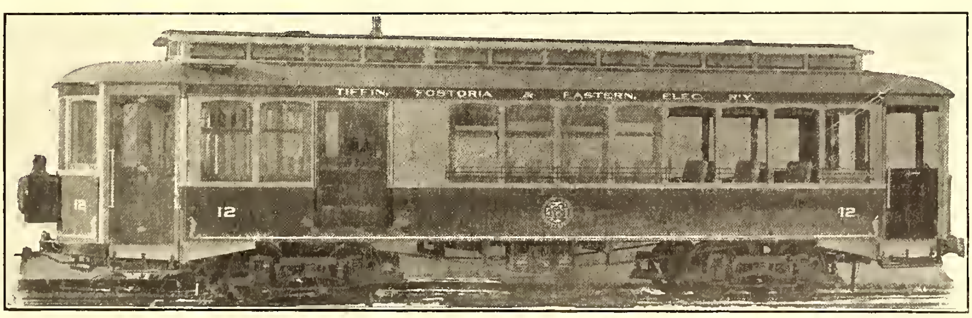
The system of interurban lines which connects the principal cities in Western Ohio, running down from Toledo and Cincinnati, operated by various companies, has a connection from Fostoria eastward to Tiffin. This line is known as the Tiffin, Fostoria & Eastern Electric Railway. It has been in operation only as far as Bascom, 16 miles west of Tiffin, and only recently extended to Fostoria. Another system is under construction between Tiffin and Fremont, and a line is proposed from Tiffin to Bucyrus and to Marion, in direct line to Columbus and the interurban systems which center there and branch off in every direction. There are several other proposed systems which will eventually connect all the important cities in this section of Ohio, and Tiffin promises soon to be one of the chief interurban railway centers. The power station and repair shop of the Tiffin, Fostoria & Eastern Electric Railway are located at Bascom, and the company owns and operates an amusement park in the suburbs of the town. It is well



INTERIOR OF TIFFIN, FOSTORIA & EASTERN CAR

suited for such purposes, as it is located half-way between the terminals. Twelve cars have been in operation, all of which are arranged for baggage as well as passenger service.

The type of car illustrated in the accompanying photographs was recently furnished to the railway by the J. G. Brill Company, and has the grooveless post semi-convertible system. It has a seating capacity of 32 in the passenger compartment and 8 in the smoking compartment. The seats in the smoking compartment are arranged to fold against the sides. The windows at the rear of the car in the illustration are raised into pockets in the side roof and show how well adapted the car is to summer service. The seats, which are of the builder's manufacture, are 36 ins. long and have arm rests at the aisle ends, and as the window sill is too low for the elbows of adult passengers, a neat arm rest is bracketed to the side panels. The hardwood partition between the compartments has windows at each side of the sliding door, and the sliding door has glass in the upper part. This arrangement gives a much pleasanter appearance to both compartments than if the partition and door were solidly paneled. The baggage compartment has the same head-lining finish as the passenger compartment, and is made as attractive as possible for smokers as is consistent with the purpose of handling baggage. Cherry of natural color constitutes the interior finish, and the ceilings are of three-ply poplar veneer tinted light green.

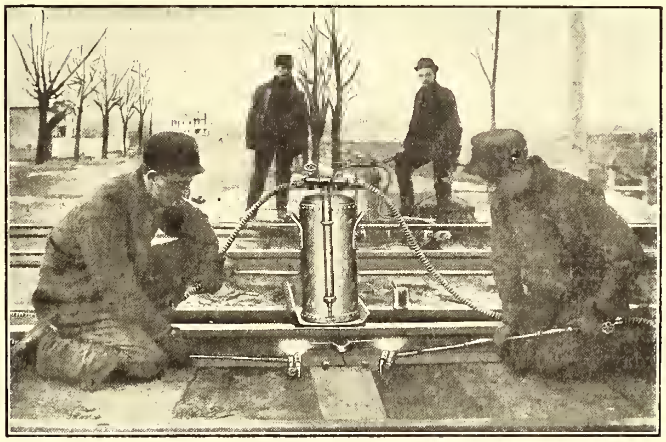


COMBINATION PASSENGER AND BAGGAGE CAR FOR THE TIFFIN, FOSTORIA & EASTERN ELECTRIC RAILWAY

The bottom framing includes 15-in. x 3/8-in. sill plates and under truss rods. Angle iron reinforced knees support the platforms at the sides, and a long pair of angle irons, extending well back to the body bolsters, carry most of the platform weight at the center. The dimensions are as follows: Length over the end panels, 34 ft. 1 in., and over the vestibule sheathing, 8 ft. 3½ ins.; height from the floor to the ceiling, 8 ft. 4½ ins. The trucks are of the No. 27-G-1 type.

GASOLINE APPARATUS FOR SOLDERING RAIL-BONDS

The efficiency of a rail bond depends so largely on the degree of contract obtained with the rail that even the best bonds must give poor results if not properly installed. Where soldered bonds are used the danger from poor labor is greatly reduced and excellent results can be obtained by employing a suitable soldering device.



SOLDERING BONDS ON THE LONG ISLAND RAILROAD

It may be recalled that the Pennsylvania railroad is employing Thomas soldered rail bonds for its electrified lines on Long Island. To install these bonds, the general contractor, Westinghouse, Church, Kerr & Company, secured over 100 outfits of an improved gasoline rail bond soldering apparatus devised by the Smith of New York Company. The accompanying illustration shows one of the double outfits as employed on a section of the Long Island Railroad at Ozone Park. A rail bond soldering outfit of this kind includes a five-gallon galvanized iron tank, two 10 ft. lengths of armored gasoline hose and a double burner and fittings. A single soldering equipment is made up of the same quantity of material, but the capacity of the tank is three and one-half gallons and but one length of hose and one burner are furnished. These simple and effective equipments are in use in so many other places where soldered bonds are applied that it would hardly be practicable to enumerate them in detail.

FINANCIAL INTELLIGENCE

WALL STREET, March 21, 1906.

The Money Market

There has been no appreciable change in the monetary situation during the past week, rates for all maturities ruling practically unchanged from those prevailing at the close of last week. The demand for money for stock market purposes has been limited, but at the same time local bankers and other lenders were not inclined to offer with any degree of freedom except at the current asking rates, there being a disposition in banking circles to regard the present ease as only temporary. During the week the final instalment on the Japanese Government loan became due, but the payment was made so as not to cause any disturbance in the local market. So far this week the banks have gained cash to the amount of about $1,300,000 on their operations with the Sub-Treasury, which compares with a loss of $301,000 in the same time last week. Receipts of currency from the interior have been larger, but the increased receipts was due largely to the arrival of funds from out of town for dividend and interest disbursement. The demand for money at the interior continues brisk, and rates for accommodations at all of the principal interior cities rule substantially above those prevailing in New York. Government finances continue to improve. Sterling exchange has ruled steady, owing to buying to cover maturing obligations abroad. It is a fact, however, that many foreign loans in the local market have been renewed. The $1,250,000 gold engaged in London last week is expected to arrive in the near future, and the engagement of $1,250,000 additional gold is reported. The European markets have displayed an easier tendency, owing to the improved political situation, but discount rates have not changed materially. The bank statement published on last Saturday was disappointing. Cash increased $1,135,600, but the loan item was $5,852,900 larger than in the preceding week, which increased the reserve required by $1,734,175, thus reducing the surplus reserve by $598,575. The surplus now stands at $5,865,125, as compared with $6,463,700 in the previous week, $5,154,175 in the corresponding week of last year, and $27,310,575 in the corresponding week of 1904.

Money on call has loaned at 9 and 3 per cent, the high rate being due to calling and shifting of loans in connection with the payment of the Standard Oil dividend and other less important distributions. Time money has held firm at 5¼ per cent for the short periods and 5 per cent for from four to six months. Commercial paper has been quiet at 5¼ per cent as the minimum.

The Stock Market

The chief characteristics of the stock market during the past week have been its dullness and manifest tendency to drag. Outside interest has been at an exceptionally low ebb, and the great bulk of the speculation has been confined to the Stock Exchange. The uncertainty that surrounded the foreign political situation until just prior to the close of the week, when the entire matter seemed to take on a rather more cheerful aspect, constituted one of the chief deterrents to bullish operations, while the prevailing doubts as to the final outcome of the conference being held between representatives of the anthracite coal miners and the operators, also served to check bullish ardor, although it is still the prevailing opinion in Wall Street that there will be no strike, and that even if there should be it certainly will prove a fizzle. The unfavorable showing made by the annual report of the Missouri Pacific likewise gave the market a temporary chill, and rumors of the serious illness of several of the most prominent men in the financial world were used by the bears in an effort to bring about a serious decline. Notwithstanding all these disturbing elements, no very serious declines in prices took place, while toward the close of the week there was a distinct rallying tendency, though still very little animation to the dealings. This upward movement was in part due to the more favorable state of the Morocian situation, although the fact that monetary conditions were somewhat more comfortable, had not a little to do with the recovery. However, the buying which brought about the rally came almost wholly from those who had previously sold stocks in the hope of realizing large profits on the short side of the account. The denial of the serious illness of the several prominent capitalists who had figured in the earlier reports, consideration of the excellent showing made by the annual report of the United States Steel Corporation, and the continued large earnings of the railroads, together with favorable advices concerning the winter wheat crop, all imparted a rather more cheerful feeling to the market at the close.

The only important development of the week in connection with the local traction stocks was the announcement of the success of the Interborough-Metropolitan plan of merger. This, however, failed to have any material effect upon any of the stocks concerned, and these, together with Brooklyn Rapid Transit, followed the general course of the balance of the market, and was likewise comparatively dull.

Philadelphia

The overshadowing feature of the trading in the local traction stocks during the past week has been the unusual activity in Philadelphia Rapid Transit, and which was accompanied by a sharp fall in the price of the stock. In the early dealings the stock held fairly well, but later on a heavy selling movement developed, which carried the price down to 27⅛, an extreme loss of 4⅜. At the low figure some support was rendered, which rallied the price about 2 points. In all about 30,000 shares of the stock were traded in. The selling was due in part to the uncertainty regarding the Mayor's action on the ordinance granting the company an extension of time for the completion of the "Market Street Subway," and to the threatened competition from the projected Philadelphia & Western Railroad Company. Otherwise the market was devoid of special feature. Philadelphia Company receipts were dealt in to the extent of about 10,000 shares, at from 54 to 53½, and back to 53¾, while the receipts representing preferred stock sold at 50⅛ and 50 for small amounts. The undeposited common stock changed hands at from 51 to 50⅜. Other sales included American Railways at 51, Fort Worth & Wabash at 28¾, Philadelphia Traction at 100¼ to 99, and back to 99½, Rochester Railway & Light preferred at 98, Union Traction at from 63¼ to 61⅞, Consolidated Traction of New Jersey at 81¾ and 81, Fairmount Park Transportation at 19, United Companies of New Jersey at 268, United Traction of Indiana at 33½ and 34, Railways General at 6½.

Chicago

The market for the local traction stocks was extremely narrow during the past week, prices for nearly all of the stocks of the surface lines affected by the recent decision of the United States Supreme Court sustaining further sharp losses on comparatively small dealings. From 170 Chicago City Railway fell to 155, on transactions involving less than 300 shares, while North Chicago stock dropped from 57 to 30, with a subsequent rally to 37, on the exchange of about 700 shares. West Chicago broke from 40 to 28, from which it rallied to 30¼. The elevated stocks also ruled extremely quiet. South Side sold at 94 and 95 for 200 shares; Chicago & Oak Park brought 6⅞ and 7, while the preferred sold from 25 to 23½.

Other Traction Securities

The market for traction issues at Baltimore was quiet but generally firm. In the early dealings the United Railway issues made further improvements, but later prices eased off fractionally. The free incomes, after selling at 75, ran off to 74, but later recovered to 74¾, about $94,000 changing hands. The deposited incomes sold at from 72¾ to 73⅜ for about $83,000 bonds, while the 4 per cents sold from 92⅝ to 92¼, and back to 92½. The free stock changed hands at 18 for 100 shares, while certificates representing 1100 shares of deposited stock sold at 18¾ and 18½. Other sales included Atlanta Street Railway 5s at 105½, Norfolk Railway & Light 5s at 100 and 100¼, City & Suburban 5s at 112¾, Macon Railway & Light 5s at 100½, North Baltimore 5s at 120, the Baltimore Traction 5s at 116¾. In the Boston market Massachusetts Electric common and preferred ruled fairly active and firm, about 1000 shares of the first named selling at 19½ and 20½, and back to 20, while a like amount of the preferred brought prices ranging from 69 to 70, and back to 69. Other sales included Boston Elevated at 155 and 154, Boston & Worcester common at 32½ to 35¼, the preferred at 81 to 84; Boston & Suburban at 22, West End common at 100 to 99½, and West End preferred at 114 and 114½. In the New York curb market the tractions have been fairly active and weak. Upwards of 12,000 shares of Interborough-Metropolitan common were dealt in at from 53¼ to 50½, and back to 51, while 5000 shares of the preferred changed hands at from 89¼ to 86, and back to 87. Interborough Rapid Transit receipts sold from 228 to 225, and back to the opening figure. Other sales included 1100 New Orleans Railway common at from 36¾ to 35¾, American Light & Traction at 102 and 102¼, and $370,000 Interborough-Metropolitan 4½ per cent bonds at 91½ to 89½, and back to 90½.

Cincinnati, Newport & Covington Traction common continues to lead in the tradings at Cincinnati, and it moved up from 51¼ to 53⅜, on sales of several hundred shares. The preferred advanced to 97¼. Several lots of Cincinnati Street Railway sold at 146¼ to 146½. Detroit United sold at par for several small lots. Several blocks of Detroit United 4½s sold at 95½. Tractions were comparatively inactive in Cleveland. Cleveland Electric suffered another decline, and about 400 shares sold at 78 and 79; uncertainty relative to the latest unfavorable measures now before the Legislature being responsible for the decline. Northern Ohio Traction & Light sold at 30¾ to 31½, on sales of about 400 shares. Cleveland & Southwestern moved up from 13½ to 14¾, on indications of greatly improved earnings. Western Ohio receipts also show indications of an advance, on reports of improved earnings, caused by through business; several small lots sold at 18¼. Toledo & Western stock has been making a strong advance at Toledo. For weeks it has been idle at 14½, but recently, on reports of improved earnings, it came into demand from certain quarters, and sold up to 18¾, and holders show an invlination to hang on.

Security Quotations

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

	Mch. 14	Mch. 21
American Railways	51¼	50¾
Boston Elevated	154½	154¼
Brooklyn Rapid Transit	84⅞	83¼
Chicago City	*a199	*150
Chicago Union Traction (common)	7½	5⅝
Chicago Union Traction (preferred)	—	21½
Cleveland Electric	80	81
Consolidated Traction of New Jersey	82	80½
Detroit United	99½	99
Interborough Rapid Transit	228½	228
Interborough-Metropolitan Co. (common), W. I.	52⅞	50¾
Interborough-Metropolitan Co. (preferred), W. I.	88½	87
Interborough-Metropolitan Co. 4½s, W. I.	90½	90¼
International Traction (common)	—	36
International Traction (preferred) 4s	—	72
Manhattan Railway	158	157
Massachusetts Elec. Cos. (common)	19	19
Massachusetts Elec. Cos. (preferred)	60	68½
Metropolitan Elevated, Chicago (common)	26½	27
Metropolitan Elevated, Chicago (preferred)	68	68
Metropolitan Street	115	112¾
Metropolitan Securities	72¼	71
New Orleans Railways (common)	35¾	35½
New Orleans Railways (preferred)	82¾	82¼
New Orleans Railways, 4½s	89	89
North American	99⅞	99½
North Jersey Street Railway	27	27
Philadelphia Company (common)	51	50½
Philadelphia Rapid Transit	30⅞	29⅛
Philadelphia Traction	*100	99½
Public Service Corporation 5 per cent notes	95½	94
Public Service Corporation certificates	74	72½
South Side Elevated (Chicago)	94½	94
Third Avenue	132	132
Twin City, Minneapolis (common)	117¾	116¼
Union Traction (Philadelphia)	63	62
West End (common)	99½	99½
West End (preferred)	114	114

* Ex-dividend. a Asked. W. I., when issued.

Iron and Steel

According to the "Iron Age," pig-iron buyers do not appear concerned about the possible effects of a coal strike; at least there is no buying that is recognized as precautionary. Negotiations between the Steel Corporation and the Bessemer Pig Iron Association for second quarter iron will be taken up shortly. It is likely that purchases in second quarter will be month by month. Specifications on contracts in all finished steel lines are at a record rate. In the lighter materials, accumulation against spring demand are still impossible. The rail trade is a conspicuous exception to the general market condition. The production record of 1906 now promises to go well beyond the 3,300,000 tons of 1905.

MUNCIE, HARTFORD CITY & FT. WAYNE NOT SOLD TO INDIANA UNION TRACTION COMPANY

In the Street Railway Journal of March 10, 1906, the statement was made that the Muncie, Hartford City & Fort Wayne Electric Railroad had been purchased by the Indiana Union Traction Company. We are informed under date of March 13, by Arthur M. Brady, president of the Indiana Union Traction Company, that no announcement, official or otherwise, has been made by the Indiana Union Traction Company to the effect that it has acquired the Muncie, Hartford City & Fort Wayne Electric Railroad, and that it had not made such acquisition.

YEAR OF THE INDIANAPOLIS TRACTION & TERMINAL COMPANY

The income account of the Indianapolis Traction & Terminal Company for the year ended Dec. 31, 1905, compares as follows:

	1905	1904
Gross receipts	$2,207,578	$1,915,104
Operating expenses	918,238	891,023
Net earnings	$1,289,340	$1,024,081
Fixed charges	1,010,343	906,715
Balance	$278,997	$117,366
Sinking fund	62,666	36,000
Surplus	$216,331	$81,366

REORGANIZATION OF EASTERN OHIO TRACTION COMPANY

The reorganization committee of the Eastern Ohio Traction Company, of Cleveland, composed of George T. Bishop, H. P. McIntosh, W. D. Rees, H. A. Everett and W. H. Lamprecht, has submitted to the stockholders a plan for the reorganization of the company. The road has been in the hands of a receiver for the past two years, and there has been no development work for several years. The committee announces that an arrangement has been perfected with the Mahoning & Shenango Valley Railway & Light Company, of Youngstown, whereby that company will build the connecting link between Leavittsburg and Garrettsville, providing the Eastern Ohio will build a diagonal line between Chagrin Falls and Hiram, the idea being to make a high-speed line between Cleveland and Youngstown, opening up a population of 135,000 within 50 to 80 miles of Cleveland. In addition to this improvement, it is deemed necessary to double track the Eastern Ohio from Cleveland to Gates' Mills, giving a 15-minute service to this growing suburb. The reorganization plan provides for the formation of the Cleveland, Youngstown & Eastern Railway Company with $2,000,000 common stock, $1,000,000 5 per cent preferred stock and $2,500,000 bonds, authorized. The scheme provides for an exchange of securities, the underlying bondholders taking preferred stock. Securities to the amount of $878,000 to be bought by the old stockholders on a basis which practically amounts to an assessment of $38.87 per share of stock, those who do not contribute to receive nothing for their stock. The amount mentioned in new money to be used for the improvement of the property. It is claimed that the majority stockholders are in favor of the plan.

MAYOR DUNNE'S REPLY TO THE DALRYMPLE REPORT

Mayor Dunne of Chicago has replied to the Dalrymple report, made public recently. The Mayor states that Mr. Dalrymple was invited to come to Chicago to report on the best course for the city to follow in acquiring and operating the lines, and not to express his opinion as to the advisability of municipal ownership. The Mayor in his reply said:

Mr. Dalrymple's letter is interesting and in some respects a valuable contribution in so far as it relates to the details of management of a municipal company. When discussing questions which fall within the line of his skill and experience as a traction employee and manager, he is instructive and intelligent. When he travels outside of that line and deals with questions of public policy as applied to American municipalities, Mr. Dalrymple's views are simply of the same value as those of any other stranger who spends a few days in this country.

The citizens of Chicago, or of any other American city, are much better able to decide upon questions of public policy as applied to their conditions and requirements than any visitor from abroad.

I invited Mr. Dalrymple to advise with me in reference to the installation and operation of a municipal railroad not because he was a student of political science, but because he was a practical manager of a municipal railway plant, who could give me advice as to its installation and operation.

If the citizens of Chicago had not already passed upon the question of the advisability of municipalizing the street railways of this city, and if I were looking for advice upon that policy, I might have invited the Lord Provost of Glasgow or some Alderman of that city to visit Chicago. But the citizens of Chicago had already disposed of that question by an overwhelming vote, and I simply desired advice from a railway manager of a municipal plant as to how to install and operate such a plant under public management.

At that time I did not know the name of the manager of the Glasgow system, but I did know from report that the system there was successfully operated, and I, therefore, asked the Lord Provost to permit their manager to come to this city to advise me.

Mr. Dalrymple has given some valuable information as to the operation of the plant in Glasgow, for which I desire to express my thanks. His unsolicited advice upon questions of public policy as applied to the city of Chicago and American cities is entitled to consideration, but only such consideration as would be accorded the advice of any gentleman from abroad who spends a few days in America.

The city of Chicago and hundreds of other American cities had long before the coming of Mr. Dalrymple decided upon and disposed of the question of the municipalization of their waterworks and electric light plants. Before his coming, the city of Chicago had decided to municipalize its street car system.

I was seeking light as to the method of the installation and operation of that municipal system. In my opinion, the citizens of this city are just as honest, as intelligent and as capable of managing their public utilities as the citizens of Glasgow or any other European or Australian city. Mr. Dalrymple, when here, spent a great deal of time in company with Mr. Mitten and other traction officials, and I have no doubt that they magnified the importance of their alleged franchises to him, and that they exaggerated the difficulties in the way of disposing of these franchises.

Mr. Dalrymple, in his letter, seems to give great weight to the "unsatisfactory state of the various franchises that have been given to the street railway companies."

He states: "If these long franchises are upheld, it would be difficult—I would almost say it would be impossible—for your city to purchase them."

The Supreme Court of the United States has just disposed of all these difficulties—if difficulties they were—so that the main objection to immediate municipalization found by Mr. Dalrymple has been removed by the decision of the Supreme Court rendered on the day that his letter was published.

We will all agree, however, with Mr. Dalrymple when he declares, as he does in his letter: "Now, presuming that the present companies are unwilling to meet you on anything like reasonable terms, what is the only course open for you? I should say, undoubtedly, to start your municipal system on each line as the franchises expire."

THE "ST. PAUL" ORDINANCE PASSED

The "St. Paul" ordinance, permitting the Chicago, Milwaukee & St. Paul Railroad to operate its Evanston branch by electricity, has been passed by the Chicago City Council. The ordinance was made conditional upon the city of Evanston passing a track elevation ordinance for the railroad within one year. Electric cars will be operated over the St. Paul tracks to Wilson Avenue, where an incline will be built to the tracks of the Northwestern elevated system, over which the cars will be run down town and around the loop. At Evanston cars operating over the newly electrified road will most probably make direct connections with the cars of the Chicago & Milwaukee Electric Railroad, which is now being operated to Kenosha, and which it is expected within a year will be running into Milwaukee. The ordinance as passed provides for a 5-cent fare within the city limits.

MAYOR DUNNE'S PLANS FOR MUNICIPALIZATION IN CHICAGO

Mayor Dunne will not send his car license ordinance to the City Council. It is said, however, that a compensation ordinance will be drafted, giving the railway companies leases terminable at the will of the city for which a percentage of the gross receipts are to be paid. The Mayor suggests three ways in which the city could secure a municipally owned street railway line in case it is authorized to borrow $75,000,000 on Mueller certificate ordinances. One way would be to make an arrangement with the companies by which the companies could improve their lines and the city reimburse them when the systems were taken over by the municipality. A third plan would be to build an entirely new system, allowing the companies to operate, until the various new lines were completed.

JOINT STEAM AND ELECTRIC SERVICE ON THE NEW YORK, NEW HAVEN & HARTFORD RAILROAD

It seems that the plans of the New York, New Haven & Hartford Railroad for electrifying that portion of its main line between Hartford and Rockville, to which reference has been made in these columns from time to time as the progress of the work has justified, is merely a step toward the application of the same general ideas to other localities reached by the company. This was made known by President C. S. Mellen of the company, in a speech before the Get-Together Club, of Hartford, on Monday evening, March 19, in which he outlined the plan for the joint use of the company's main line and the street railroads in cities. The scheme in brief is to run electric trains on the main line of the company from the suburban points. These trains will make the same speed that the ordinary suburban trains would. Instead of going into the stations, however, they will be switched off the main line after entering the cities, and will run on the street railway tracks, giving the same service as street cars. The purpose of the plan is to avoid the necessity of discharging passengers at stations and forcing them then to take the street cars. When the new system is in operation in the various cities of Connecticut the suburban passenger can take his train at his station, have a fast run to the city, and then be conveyed in the same car into the heart of the business district. In his speech Mr. Mellen said:

"We would like to make the experiment on a large scale to determine whether the two systems of traction—steam and electric—may not be worked in common, each supplementing the other, and we would like to electrify our steam tracks between here and Waterbury, and on the Central New England Railway between here, New Hartford and Springfield, and on the east side between here and Rockville, Melrose and Springfield, and upon the Valley line between here and Middletown.

"Instead of running to and from our stations through our yards, with all the switching and delays incident thereto, we want to connect at convenient points with the street railway tracks, and for interurban service make a circuit of the principal streets, collecting and delivering suburban shoppers at the store doors, and we believe both the city and the railroad will be greatly the gainers thereby. "No city on our lines is so favorably situated as is Hartford for the development of this idea."

In order to carry out the idea Mr. Mellen explained that it would be necessary to substitute T-rails for the usual grooved trolley tracks.

"Now, what we want," he continued, "is that you shall permit us to use on the streets where this suburban service will naturally go, the T-rails we use in other cities, New Haven, for instance, and, waiving none of your rights under your contracts, see how it will work, ascertain if the objections are real or imaginary, and if you find there are more obections than advantages after a two years' trial, we will take up the T-rails, restore the grooved rails, and go back to the old order of things.

"I am not afraid of your decision—I will trust you, and if you are afraid to trust me, I will secure the performance of my part of the contract by a good and sufficient bond to your satisfaction. Let me suggest right here that I am advised the contract requiring the use of the grooved rail is not binding in law, but I have none the less required its observance on the part of our company, and shall continue to until we can agree amicably upon its modification.

"I shall be most seriously disappointed if you force me to go elsewhere to try the experiment. The proposition is knocking at your doors, such an opportunity as no other city has to-day."

THE PURPOSE OF THE BALTIMORE COMPANY

The proposed amendments to the charter of the Maryland Electric Railway Company have aroused so much discussion, and there have been so many rumors concerning the charter, that the executive committee of the United Railways & Electric Company, for the information of the Legislature and the security holders of the company, decided to issue a formal statement. An announcement was therefore made in the daily papers, of which the following is an abstract:

When, after the fire, the plans for the rehabilitation of the property of the United Railways & Electric Company was determined upon, money was needed, broadly speaking, for four essential purposes: (1) Relaying and repair of track; (2) The purchase of new and the repair of old equipment; (3) The building of new and the repair of old car houses and buildings, and (4) The extension to and development of that portion of the suburbs of the city now unsupplied with lines.

For tracks, cars and car houses alone, the expenditure of over $4,000,000 was required. Hence arose the cry for "refinancing" of which we heard so much a year or so ago. This was steadily refused by the directors, owing, among other reasons, to the heavy cost to the company and their objection to issuing new securities upon the property of the United, and it is believed that it was not long before the business community appreciated the wisdom of this course. In the opinion of the board, it would have been a costly experiment to have refinanced the United, and the following policy was therefore adopted. The relaying and repair to its own track should manifestly be made and is now being made by the railway company itself out of its earnings. The purchase of new equipment has been made through car trusts, and satisfactory prices have been obtained for the certificates.

Items (1) and (2) having thus been provided for, the Maryland Electric Railway Company is designed to take care of the items (3) and (4), namely—car houses, buildings and extensions.

The new company proposes to spend such an amount as may be deemed necessary for the erection of new car houses and buildings for the use of the United, and to purchase or build such extensions to the United's system as may be deemed advisable. This is the reason for asking the amendments to its charter, as a proper examination and analysis of the amendments will show.

So far, the expenditures have been met out of income, but the heavy cost of such a car-house system and the building of suburban lines should not be paid for out of income, if other means can be devised, as it is not the intention of the directors to defer payment of interest on the income bonds a day longer than it economically advisable. By the use of the Maryland Electric Railway Company's charter, money can be raised on its securities on more satisfactory terms than on any additional obligations of the United, and the income bondholders can much sooner expect a return on their investment.

When the various lines were consolidated, the company acquired a number of car houses, built, of course, without any relation to the operation of the lines as a unit. Such a system of operating and storage car houses as is proposed is not only absolutely necessary for the protection and preservation of the company's costly equipment, but will put the company in a position to greatly improve its service and handle the crowds during the rush hours.

Approximately, $1,600,000 has been spent in the past two years in improving the United's service. It is contemplated that by the use of the Maryland Electric Railway charter, the service of the company will be greatly bettered and its part in the development of the city and suburbs accomplished with much greater rapidity.

It is to be hoped that the Legislature will see its way clear to pass the suggested amendments to the Maryland Electric Railway Company's charter and enable the United Company to carry out the above plan; otherwise it may be necessary for the company and the public to wait until the needed expenditures can be made out of the income.

CHANGES IN A CALIFORNIA ROAD

At the regular monthly meeting of the directors of the Petaluma & Santa Rosa Electric Railway, an entire reorganization of officials took place. William A. Cattell, of New York, the personal representative of the banking house of E. H. Rollins & Son, of Boston, was elected to the presidency, vice John A. McNear, resigned; John A. McNear was chosen vice-president to succeed W. F. Kelly, who tendered his resignation; Rudolph Spreckels, of San Francisco, was chosen a director, succeeding Burke Corbett, who resigned his place on the directorate, but is retained as the attorney for the company; Thomas Archer, the secretary of the company, was also made treasurer. The directorate of the corporation is now composed of William A. Cattell, John A. McNear, Rudolph Spreckels, Francis Cutting, W. H. Talbott, Thomas Archer and Frank A. Brush. Messrs. Cattell and Spreckels intend to devote their entire time and attention to developing the new electric railroad, and to furthering its interests.

TWO-CENT FARES NOT AFFECTING ELECTRIC LINES

The 2 cents per mile fare measure which went into effect in Ohio last week has not thus far perceptibly affected the business of electric roads. On the contrary, in a great many cases it has resulted in the steam roads removing a number of cheap competitive rates between local points, thus leaving the field entirely to the electrics. There has been some fear that it might injure the long-distance business which the electrics are developing, but no change in this branch is apparent. For instance, the old steam rate from Cleveland to Toledo was $3.25. The reduction brings this to $2.15. The rate of the Lake Shore Electric Railway between the points mentioned remains at $1.75, and the through cars seem to be carrying just as many passengers as heretofore. In one or two instances, notably along the Western Ohio Railway, it is stated that the steam road has cut below the rates of the electric, but at the same time some of the trains have been taken off, so that the advantage still remains with the electric road. Between Cleveland and Akron the steam road has taken off its cheap round-trip rate on one of its trains, resulting in the electric line putting on an extra limited car between these points. Round-trip, charity tickets, clergymen's tickets and other classes of reduced rates have been eliminated. It is very probable that rates for Sunday excursions, heretofore very low, will be increased, or excursions eliminated entirely. So far as can be learned, only one electric road has made a reduction in fare to meet the steam rate.

PHILADELPHIA & WESTERN SEEKS TO ENTER PHILADELPHIA—RAPID TRANSIT AND CITY AGREE

On Wednesday, March 15, a communication was received by Mayor Weaver of Philadelphia from the Philadelphia & Western Railroad, now building an electric railway westward from the Philadelphia county line to Parkersburg, a distance of 44 miles, relative to a grant from the city for an elevated and underground railway from Sixty-Third and Market Streets, the western boundary of Philadelphia, across the city to the Delaware River, a distance of about 5 miles. The line, if constructed, will parallel the elevated and underground railway now being built by the Philadelphia Rapid Transit Company. In general character the contemplated railway is similar to the line now under construction; that is, an elevated road from Sixty-Third Street to the eastern bank of the Schuylkill River, where the trains will dip into a subway which will extend to the Delaware River.

The communication of the Philadelphia & Western Company states that if it obtains the franchise to enter the city the company will agree to pay to the city 2 per cent of the gross receipts from the transportation of passengers within the city during the first two years of the line's operation, 3 per cent during the third year, 4 per cent during the fourth year, 5 per cent during the fifth year, and thereafter 5 per cent of its gross receipts annually for thirty years. At the end of this period the company will agree that the entire line within the city shall be transferred to the city of Philadelphia, but the company is to have an option to lease the railway for a further term of forty years for an annual rental of $400,000, plus 5 per cent of the gross receipts from business within the city. At the end of the term of the lease the company is to deliver the entire property to the city. The company also agrees to complete the line in three years.

There was no discussion in Select Council when the communication was read, and it was referred to the committee on railroads. Common Council took up the ordinance granting an extension of three years to the Philadelphia Rapid Transit Company for the completion of the subway along Market Street east of City Hall, and it was passed with little opposition.

The Philadelphia Rapid Transit Company on Tuesday, March 20, agreed to complete within three years subways under several streets in the business center of the city, and an elevated railway from the southern section of Philadelphia to Frankford, in the extreme northeastern section of the city. The company surrenders franchises for surface lines on Broad Street, for two elevated lines, and the franchise for a subway under Chestnut Street, which, it is believed, will permit the Philadelphia & Western Railroad to construct its proposed line from West Philadelphia through the heart of the city to the Delaware River, connecting on the west with its road to Parkersburg. The Rapid Transit Company will also pay to the city $400,000 in cash, to be used in abolishing Philadelphia & Reading Railway grade crossings.

IMPORTANT CANADIAN RAILWAY BILLS

Two important railway measures were introduced in the Legislature at Toronto last week by Hon. J. S. Hendrie, after having been carefully gone over and approved of by the Cabinet. The first of these bills deals with general railway matters, and applies to every railway and street railway under provincial jurisdiction, whether incorporated or to be incorporated, or whether now operating or to be operated. Numerous reforms are to be inaugurated by the new legislation, and it will settle many of the vexed questions of railway control in the province. For instance, where a road ceases to operate for a period of eighteen months, as some have done, the difficulty may be overcome by the confiscation, under the act, of the line, exclusive of rolling stock, by the municipality. Fares, too, are dealt with, and a standard of practically 2 cents a mile is ordered. Provision is made for the settlement of problems arising out of the entry of radial lines to cities. In future, should outside lines petition for admission, should municipalities desire their entry, or should street railways ask that entry be permitted and terms not be reached, the New Ontario Railway and Municipal Board, which is to be formed, may settle all conditions.

All apprehension regarding perpetual franchises will be ended when the bill becomes law, in view of the fact that a limit of twenty-five years is set on such privileges. Of course there is provision for the renewal of charters, but the municipalities are empowered to take over railroads if they desire. Examinations of motormen and officials are to be inaugurated and conductors are to have the powers of constables. Finally, all new roads are to have a standard gage. There is no alteration in the clauses dealing with the operation of cars on Sunday.

The second bill makes an important advance in the railway legislation of the province by creating a provincial railway and municipal board, which will not only have the power to deal with all railways holding provincial franchises analagous to the power of the Federal Railway Commission, but will also have a considerably wider scope than the latter commission. There will be no appeal from its rulings to the Lieutenant-Governor-in-Council on matters of fact. The only appeal allowable will be to the Court of Appeal on matters of law. Moreover, it will have all the powers now conferred by the Municipal Act upon the Lieutenant-Governor-in-Council in respect to the confirming of municipal by-laws, extension of boundaries, and the enforcement of agreement with companies holding municipal franchises. It is also provided that in any case where a railway company refuses to carry out its agreement with a municipality the board may take over the entire management of the road and operate it until a satisfactory agreement is reached.

INTERURBAN TERMINAL AT LOUISVILLE

Plans have been completed by the Louisville & Southern Indiana Traction Company for the erection of a terminal building for interurban cars entering Louisville over its tracks, which will be the finest and most commodious south of the Ohio River. The details were completed a few days ago, when the property adjoining the present terminal building on Third Avenue, Louisville, belonging to William Richter, was sold. Mr. Shulz has agreed to grant the traction company a ninety-nine-year lease on the property. The traction company proposes to extend the present building over the additional property, which fronts 37 ft. on Third Avenue, thus securing a frontage of about 100 ft. This building will then be built three stories higher than at present, and it is said that arrangements have been made for the occupancy of the upper stories. Four tracks will enter the building, which will be 100 ft. x 200 ft. in total dimensions. The height will equal a 5-story building, owing to the necessity of making the first floor high enough to permit the entrance of cars.

The present plans are to build at least two stories additional and to lease the upper portion of the building to a manufacturing firm. Twenty thousand feet of floor space will be secured on each floor of the building when completed, and a Louisville firm is negotiating to secure the entire building, which will not be used by the traction company. These extensions of the building would provide, if necessary, offices for the traction company upon the upper floors of the building, and it is believed that the central offices of the company, which are located at New Albany at present, will soon be moved to Louisville. The remainder of the building, it is believed, can be leased with comparative ease. When completed, the structure will represent an investment of more than $300,000, including the property leases.

BAHIA, BRAZIL, TO BE ELECTRIFIED

Guinle & Company, of Rio de Janeiro, Brazil, representatives of the General Electric Company, have closed a contract for the electrification of the tramway lines in Bahia, Brazil, and T. Guinle, of the firm, is now in the United States in connection with the project. The contract to the General Electric Company includes the machinery for the initial change. A new power house will be erected, to contain a steam plant, made up of Babcock & Wilcox boilers with Worthington condensers, furnishing steam to one 500-kw, 2300-volt, three-phase, 60-cycle Curtis turbine of standard construction, and one 300-kw, 2300-volt, 60-cycle Curtis turbine self-excited generator. Other station apparatus will include three 200-kw, 600-volt, direct-current generators, driven by 300-hp 2080-volt induction motors, and three motor generator sets, each consisting of a 150-kw, 600-volt generator, driven by 225-hp, 2080-volt induction motor. The equipment contract also includes 40 miles of trolley line material, track bonding, etc., and motor equipments for thirty-six cars, on each of which will be installed two-motor, 40-hp equipments. The 300-kw Curtis turbine generator is the first one to be shipped, which is built after the design with the self-exciting generator, described in Mr. Alexanderson's paper before the recent meeting of the American Institute Electrical Engineers.

CONSOLIDATION OF PENNSYLVANIA AND NEW YORK COMPANIES

William F. Sheehan, of New York, has organized a $10,000,000 company which will establish an electric railway between Buffalo and Erie. Properties purchased and amalgamated by the new company are the street railway lines of Erie, Pa., the Jamestown & Chautauqua Lake Railway Company, the Chautauqua Lake Steamship Company, the Buffalo, Dunkirk & Western Railway, the Dunkirk & Fredonia Railway Company and the Hamburg Railway Company.

THE BOSTON SUBWAY PROBLEM

At a hearing before the legislative committee on metropolitan affairs, held in Boston on March 15, President William A. Bancroft, of the Boston Elevated Railway Company, submitted arguments in opposition to the recommendations of the Boston Transit Commission for additional subways. He stated that in his opinion there is no immediate need for additional subway facilities, because the existing provisions will relieve the present congestion, and also because of the expense, for which there is no justifying revenue in sight. In the last eight years the investments of the Boston Elevated have increased from $26,000,000 to $61,000,000, or 130 per cent, whereas in the eight years previous, when the old West End Street Railway Company was changing over its motive power from horses to electricity, the increase was 127 per cent. In the last eight years the passenger traffic has increased less than 50 per cent.

Soon $17,500,000 more will be expended, of which the Washington Street tunnel will take $7,000,000, the Cambridge transit provisions $7,500,000, and the Forest Hill elevated extension $3,000,000. This means an increase of $250,000 in the fixed charges, and this revenue is not yet in sight. The company believes that the proposed subway east of Washington Street is unnecessary.

Gen. Bancroft then pointed out that the completion of the Washington Street tunnel and the Cambridge subway will do much to relieve the present congestion in the subway and on Boyleston Street, especially as the Washington Street tunnel provides a short direct route. Eight-car trains will be run in the latter every 1½ minutes. In the present subway trains are limited to five cars. The existing subway has a capacity of 250 surface cars per hour on the Park Street loop, or 8500 seats; the through part has a capacity of 7500 per hour, making a total of 16,000 per hour. The Washington Street tunnel will have a capacity of 16,000 people per hour, and the existing subway, with new cars, a capacity of 10,000 per hour in each branch, making a total of 36,000. The Cambridge subway will handle 16,000 more, making a total of 52,000 per hour, or an increase of 225 per cent. The extension of the present subway to Copley Square would relieve Boylston Street, but would not increase the number of cars per hour, as the maximum number which can be handled is 250 on the Park Street loop. Gen. Bancroft concluded by stating that if the Commonwealth Avenue subway was found to be impracticable his company would rather spend money for a Charles River embankment route than for a new subway for surface cars east of Washington Street.

Street Railway Journal

Vol. XXVII. NEW YORK, SATURDAY, MARCH 31, 1906. No. 13.

Published Every Saturday by the

McGraw Publishing Company

Main Office:

NEW YORK, Engineering Building, 114 Liberty Street.

Branch Offices:

Chicago: Monadnock Block.

Philadelphia: Real Estate Trust Building.

Cleveland: Cuyahoga Building.

London: Hastings House, Norfolk Street, Strand.

Cable Address, "Stryjourn, New York"; "Stryjourn, London"—Lieber's Code used.

TERMS OF SUBSCRIPTION

In the United States, Hawaii, Puerto Rico, Philippines, Cuba, Canada, Mexico and the Canal Zone.

Street Railway Journal (52 issues)....................$3.00 per annum

Single copies ....10 cents

Combination Rate, with Electric Railway Directory and Buyer's Manual (3 issues—February, August & November) $4.00 per annum

Both of the above, in connection with American Street Railway Investments (The "Red Book"—Published annually in May; regular price, $5.00 per copy)....................$6.50 per annum

To All Countries Other Than Those Mentioned Above:

Street Railway Journal (52 issues), postage prepaid.................... $6.00

25 shillings. 25 marks. 31 francs.

Single copies ....20 cents

Remittances for foreign subscriptions may be made through our European office.

NOTICE TO SUBSCRIBERS

REMITTANCES.—Remittances should be made by check, New York draft, or money order, in favor of the Street Railway Journal.

CHANGE OF ADDRESS.—The old address should be given, as well as the new, and notice should be received a week in advance of the desired change.

BACK COPIES.—No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

DATE ON WRAPPER shows the month at the end of which the subscription expires.

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office by 10 a. m. Monday preceding the date of publication, except the first issue of the month, for which changes of copy should be received two weeks prior to publication date. New advertisements for any issue will be accepted up to noon of Tuesday for the paper dated the following Saturday.

Of this issue of the Street Railway Journal, 8000 copies are printed. Total circulation for 1906 to date, 106,300 copies, an average of 8177 copies per week.

Cleanliness of Trainmen

A short editorial last week commented upon the desirability of bathing facilities in the car house and it might not be out of place to discuss the subject further, especially in its relation to the morale of the men, who are practically the only representatives of the line whom the patrons see. A commercial house realizes that to a great extent its reputation is made or is destroyed by the personal appearance of the men on the road and it picks its representatives with this fact in mind. The result is that traveling men as a class are very neat in their dress and capable of making a good impression. It may be argued that the wages ordinarily paid to conductors are not sufficient to attract this class of men. This may be so to some extent, but with this point in mind in selecting men and with proper co-operation and encouragement on the part of the company, it should not be a difficult task to set a standard which men of the proper stamp would be glad to live up to.

A man does not necessarily have to be highly educated to be clean or to appreciate cleanliness. If companies would insist on the personal cleanliness of their trainmen and would encourage them to clean up by providing clothes brushes, wash basins and other facilities at convenient places, their appearance would often be wonderfully improved. In some cases, the men might be absolutely compelled to alter their habits, but in the majority of instances, we venture to say, it would be necessary only to make the proper provisions for baths, provide a barber shop at a convenient point and offer other means of cleaning up.

Columbus as the Convention City

The important announcement is made elsewhere in this issue that the national street railway conventions this year are to be held in Columbus, Ohio. The executive committee decided soon after the Philadelphia convention that the proper place for the next meeting was in the Middle West. The interurban railways of Ohio, Indiana, Michigan and Western Pennsylvania have developed so rapidly that it was felt no more interesting or instructive place to hold a meeting could be found this year than in one of the cities in this district. At the same time, the number of attendants at an annual street railway convention is now so large, and the requirements in the way of hotel and exhibition accommodations are so considerable, that there was doubt in the minds of some as to whether any city, outside of the very largest in the country, could accommodate the convention. It was decided, therefore, to canvass carefully the facilities afforded by every city within this district; letters were also sent to the local companies in many of the cities and communications were received both from them and from the boards of trade. Several cities in the territory mentioned expressed a desire to have the convention at some future date, but owing to inadequate hotel facilities, or for want of a proper place to exhibit, or both, they felt it would be impossible to do anything for the convention this year. Columbus was found, however, to possess all of the requirements demanded and the selection in its favor was made after a personal tour of investigation to it and other cities on the part of a committee appointed for that purpose, and which included President Ely. As Columbus is the State capital and has taken care of many conventions, the hotel accommodations are especially good. In fact, it has four large hotels which can guarantee 600 first-class rooms. In addition there are other smaller but thoroughly good hotels which can guarantee 600 more rooms during the convention week. It will be remembered that the Bellevue-Stratford last year provided only 400 rooms for the convention attendants and all others who went to the convention had to secure accommodations elsewhere.

It was also found that the State Fair Grounds at Columbus offered excellent facilities for the annual exhibit of the Manufacturers' Association. These grounds are within 15 minutes' ride of the principal hotels and are reached by two lines of trolley cars. They are probably the finest State Fair Grounds in the country, and contain several large brick buildings which are connected with covered passages and which contain in the aggregate 120,000 sq. ft. of floor area. In addition there are suitable halls for the convention meetings of the various associations. The association has been assured of the cordial co-operation of the Columbus Board of Trade, which is a strong organization, consisting of the representative business men in the city, with a membership of 1200, and of the Columbus Railway & Light Company in making the convention a success. In addition the managements of many of the interurban electric railway systems centering in Columbus, Dayton, Indianapolis, Cleveland and Cincinnati have proffered every facility in their power to add to the success of the meeting.

We heartily congratulate the Executive Committee of the Association upon the choice of Columbus, and are confident that its selection is an ideal one from every point of view. We believe that many street railway managers in the East and Far West, who have not actually seen and traveled upon the interurban electric railways in Ohio, Indiana and neighboring States, have but a faint idea of the progress made in high-speed electric railroading in this territory. It is true that in our reading columns and editorials we have given a great deal of space to this work, but, as in many other instances, the actual installation must be seen to be fully appreciated. We believe the choice a wise one, and that a trip to Columbus at the time of the convention will be an object lesson which will be most instructive.

A Radical Departure in Interurban Service

The address of President Mellen and the contract of the West Shore Railroad for electrical equipment between Syracuse and Utica, to both of which we alluded last week, constitute an important, we might even say revolutionary, departure from previous methods in transportation. Heretofore the trunk steam railroads and the electric interurban or city railways have been conducted upon different and, in many cases, antagonistic lines. Although the former has usually had the advantage of speed, it has suffered in the competition for suburban traffic from the fact that it carried its passengers to a fixed rendezvous instead of dropping them at convenient points in the business district. It could, of course, connect with the street car lines but, as we have over and over reiterated, a change of cars should never be required if it can in any practicable way be avoided. Of two routes, one involving a change of cars and the other avoiding it, the latter will win the bulk of the traffic even if it operates at lower speed and charges as much or a little more fare. The road that compels a change of cars loses both friends and traffic, which, by the way, is a sufficient reason why so little has been done in long distance electric railroading. A trip from New York to Boston, or even to Chicago, might be made with few breaks, but the changes encountered in much shorter distances forbid this sort of traffic. If a suburban road coming into the city over its own right of way can at the same time distribute its passengers without change of cars, the gain in facility is of very great importance to the public.

Now the managements of both the West Shore and New Haven railroads propose to run suburban cars between neighboring cities on the steam tracks, and then, instead of taking them into the regular terminal stations, shunt them directly upon the street tracks and distribute passengers in the ordinary way. It is the same sort of thing that is done on many interurban lines, but on a scale even broader and more complete. It takes the passenger at his home and conveys him at railroad speed to the city and then to his office or near it without change. It gains time during the long run and puts it to good use in distribution of passengers. Incidentally, however, the plan will fall foul of the very same difficulty with which interurban lines are familar, that the wheels proper for high-speed work are not suitable for the grooved or girder rail and special work so generally used in city streets. A wheel of somewhat narrow tread and smaller flange than that required by the M. C. B. standard could undoubtedly be used with safety for high-speed work, but even if adopted it would still be large for the usual city track. On the other hand, the ordinary flange used on city track is too small for the interurban sections unless the speeds on them is kept low. The only logical solution, in our opinion, is that offered by President Mellen in his Hartford address, viz., the use of T rails in cities, and it seems to us that the gain made by avoiding a change of cars is sufficient to overcome any objection to this plan.

So long as interurban cars are operated along highways for long distances there is bound to be trouble in keeping to schedule. The only way to maintain time and headway satisfactorily is to run so many cars that waits will be short. Probably the very worst service to be found is on some suburban electric lines where the cars run on fifteen-minute or twenty-minute headway and do not keep their spacing. In such cases it generally happens that if two distinct lines use the same track they fall into pairs, so that one has, say, six cars per hour on twenty minutes headway, which is a very different thing from six per hour equally spaced. But working over a private right of way, whether belonging to a steam railroad or interurban electric line, cars can hold their schedule with precision, and thereby greatly improve the traffic conditions from the standpoint of the public that pays the fares.

The plan announced by the New Haven and West Shore managements strikes us in principle as a very useful one indeed, and we trust that each of these companies will be enabled to carry it out on a scale large enough to show its benefits. And working along the same line of reasoning, we hope that the cars will be given a terminal loop sufficiently large to give the passengers a fair chance. If city authorities would only realize the rights of passengers instead of concentrating a stony glare on the supposed privileges of the street railways, rapid transit would be mastered in many places. It is not the passenger who is carried quickly and conveniently to his destination who howls for a no-seat no-fare ordinance, but the fellow who has had to change cars a couple of times, and possibly pay two fares, because the city fathers were afraid some "grasping corporation" would increase its earnings if given locations where people wanted to go.

When Does a Road Pay?

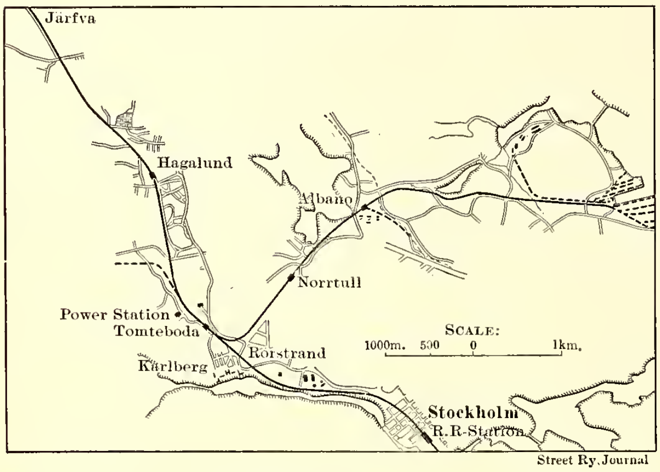
On the face of the words, this seems a remarkably simple question to be answered by anyone blessed with ordinary commercial acumen. When one stops to think it over, however, it does not seem quite so clear, and the more one considers it the more it becomes evident that there is a chance for wide differences of opinion. That such differences exist, is evident itself from the divers views held regarding the present status of the electric railway business throughout the country. We often hear and occasionally think that road building is overdone, and that many roads are in a bad way. Doubtless they may be, yet on the other hand it should be realized that some roads, compelled by conditions to make rather discouraging reports, are yet in fair condition and likely to become successful. Broadly, a road may properly be said to pay when it yields above its operating and general expense, repairs and maintenance, values sufficient to pay a fair rate of interest upon the capital actually invested in it. From this point of view, the outlook is not upon the whole a discouraging one, considering that this is a growing country, with strong probability of a revenue increasing year by year. That a road does not pay dividends upon its common stock, does not indicate that it is upon the road to insolvency or that its construction was ill-judged. More often, it merely shows that its construction was ill-financed, so that it is paying upon its funded debt the surplus which really ought to be available for dividends. There are many cases of this kind in which the system is actually earning six or eight per cent net profit upon every dollar of its actual cost, and yet must wait perhaps for half a dozen years of growth before enjoying apparent prosperity. Exactly the same conditions have been seen in the earlier days of ordinary railroading, in which there was a strong tendency to gamble upon the future of the tributary territory, and steam roads have suffered from high finance to an extent unknown in even the electric roads most open to criticism.

But we do not wish here to point out the financial mistakes or misfortunes of the transportation business. Rather, we desire to call attention to some of the larger benefits which accrue, and which too often are forgotten as outside the ordinary provinces of bookkeeping. We got the other day one of those inquiries which not infrequently fall to our lot, respecting the probability of financing an interurban road from, let us call it, Doe City to Roeville. The unusual feature of the project was the intimation that there was a strong sentiment in the towns along the proposed route in favor of lending direct financial aid in its construction. Such plans have been carried out before, but here was direct evidence of a popular faith in the electric roads well worth thinking about. The locality was not specially favorable, and the road would have to contend with rather light traffic for some years. With its public behind it, however, the outlook changes very materially for the better. The road would have cost to build, perhaps, $250,000, and there would be at 6 per cent, $15,000 annual charges to be paid. The traffic in sight would not do much more than pay this, and take care of the operating expenses and up-keep. It did not look at first thought in the least promising. But here is the other side of the matter. The road would run through an agricultural district in which there were many summer visitors. Tributary to it were not less than 10,000 acres of land and two or three prosperous villages. These are not assets from the standpoint of the ordinary investor, but what would they mean to the inhabitants considered as part owners of the road.

Considerable experience can be brought to bear in answering such a question. One can only generalize on matters of price, but it would be well within bounds to hazard an estimate that within five years the salable value of those 10,000 acres would increase by not less than $50,000, and perhaps by double that amount. Is not this sort of cash bonus to the participators a part of the legitimate profit of the enterprise, just as much as if paid in dividends? Even if the road merely struggled along for the whole five-year period, it would earn in increased values every year a very substantial sum. More than this, it would have the friendly interest of the entire community, which is a practical asset of considerable though indeterminate value. This is the way in which rural roads can be made profitable, and the process has been applied in a good many cases with excellent results. It is not one that promises quick profit to the promotors, unless they participate in the inurement of valuation, but it does develop the country, and it furnishes a small group of roads that on the face of the books may look discouraging, but which has a future. We can call to mind examples of such roads which have never paid a dividend on the stock and have for some years been in the discouraging column, yet, in fact, have paid fair interest on the capital invested, and have pretty nearly paid for themselves in increased valuations. The community, which furnished part of the funds, has profited by its enterprise. This sort of thing can obviously be applied to many isolated cases without constituting anything like a general fixed plan of action. Here and there a failure might be scored, but where there exists a reasonable prospect of traffic a road backed by strong local interests will succeed where one without it would fail. And this, by the way, is one of the adverse elements sometimes encountered in consolidations, by which the active management is far outside the community served. Of all the electric roads built, few have failed of public usefulness, and few can not be pulled through into a reasonable measure of prosperity in due season. The key to the situation is getting next to one's constituents in railroading as in politics. It is to be noticed, that in spite of gloomy views of electric railroading and the difficulties certainly met by some roads from unwise financing, building still goes actively along, and as the population grows the need of transportation increases in even greater proportion.

EXPERIMENTAL SINGLE-PHASE INSTALLATIONS FOR THE SWEDISH STATE RAILWAYS

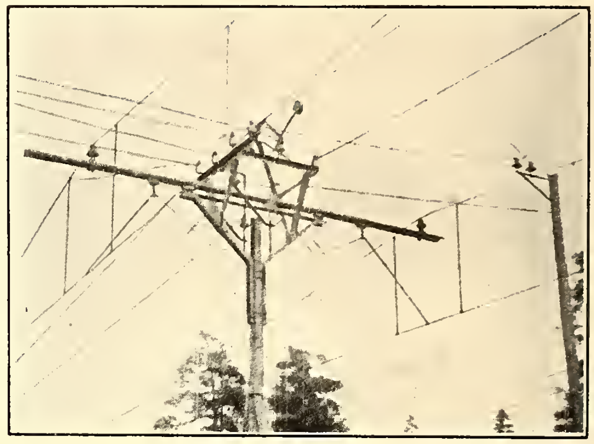
As already noted in these columns at the time, the Swedish Government appropriated $115,000 some time ago for the purpose of carrying out electric railway experiments on two short lines near Stockholm, the eventual object being the electrification of the Swedish State Railways. The first trial trips were made last June, but as the experiments are to continue during the year 1906, little can yet be said regarding the results. It may be of interest, however, to present a brief description of the trial equipments.



MAP OF RAILWAY LINES NEAR STOCKHOLM ON WHICH THE SWEDISH GOVERNMENT IS CONDUCTING ELECTRIC RAILWAY EXPERIMENTS

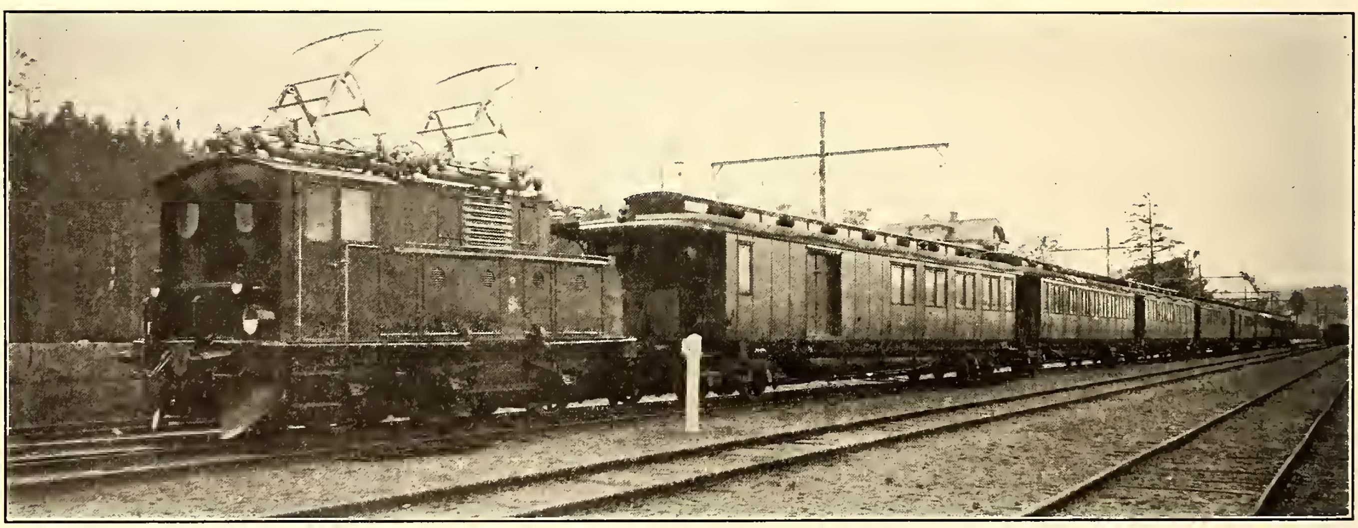
The experiments are to be confined to single-phase work, preliminary investigation having shown that this would be better under the Swedish conditions than three-phase. The reasons giving for deciding upon the former type were the great distances between stations, giving a lower cost of installation on account of using only one wire, the single-phase hydro-electric stations, the possibility of using a higher trolley voltage and the fact that commutator motors could be regulated with greater nicety for varying traffic conditions. A further reason given was that the single-phase apparatus had been developed to a more practical stage than three-phase railway apparatus. While it would have been interesting to compare both systems under like conditions, it was felt that this would only complicate matters, and besides, the behavior of three-phase railway apparatus was already well known from experiments on other lines.

The experimental lines are shown in the accompanying map, on which the power station is also indicated. At present work is going on along the 6-km division between Tomteboda and Värtan, the customary number of trips being eighteen but occasionally more are made. It is planned later to install a regular service between the Stockholm railway station and the suburban town of Tärfva, using a four-car train made up of two motor cars and two trailers. The Stockholm-Tärfva line is 7-km long and is doubled-tracked between Stockholm and Tomteboda. It is also planned to institute for some time freight haulage between Tomteboda and Värtan with electric locomotives.



SECTION INSULATOR

The provisional power plant erected for these experiments is about a quarter-mile from Tomteboda. It is steam driven and was installed more with a view to cheapness in first cost than economy in operation, as the boilers and engines will probably be given up when the experiments cease. Two of the four locomotive boilers installed furnish steam to two 270-hp DeLaval turbines, each of which is connected through gearing to a double generator. The halves of the double generator are connected in series while the generators themselves are in parallel. Each half has four poles and the machines, when running at their normal speed of 750 r. p. m., give 600 volts at 25 cycles. By properly manipulating the turbine regulators, the speeds can be varied to secure 15-cycle or

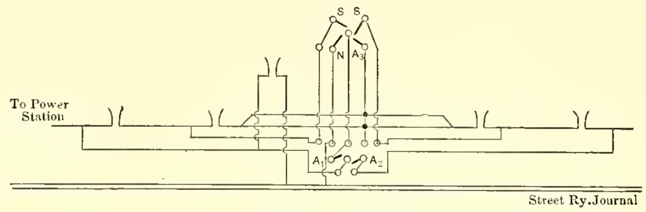


SINGLE-PHASE LOCOMOTIVE DRAWING TRAIN ON SWEDISH STATE RAILWAYS

20-cycle currents for experimental work. The generator leads are carried to step-up transformers which are furnished with taps to give a large range of voltage up to 37,500 volts. So far, the trolley potentials tried have been varied from 5000 volts to 15,000 volts but later on 20,000 volts to 22,000 volts will be used.

The trolley wire has been suspended in different ways to work out the best type of overhead construction. On one division, between Albano and Värtan, the wire is suspended in the customary way with single insulation from the earth, but in general catenary suspension prevails and double insulation is employed. Most of the poles are of wood, the remainder consisting of armored concrete. The insulators can be shifted along the bracket arms to secure the zig-zag arrangement of the trolley wire used to permit an even wear of the bow collectors. It is also possible to vary the height of the trolley wire. In one instance when two 6-mm. diameter steel catenaries are provided, the maximum distance between poles is 60 m. and where there is only one catenary of the same diameter, 50 m. With the single catenary it is believed the distance between poles can be made 75 m. The trolley wire in this case is suspended from a steel wire having a cross-section of 70 sq. mm. The vertical supporting wires are placed 3 m. apart, but for a short distance between Albano and Värtan this interval has been increased to 10 m. When the single wire without catenary is used an arrangement is provided at every pole which creates an immediate short circuit in case of wire breakage. On the catenary divisions this protection has been installed only at stations and street crossings. The trolley wire has a cross-section of 50 sq. mm, part of it round and the remainder grooved.

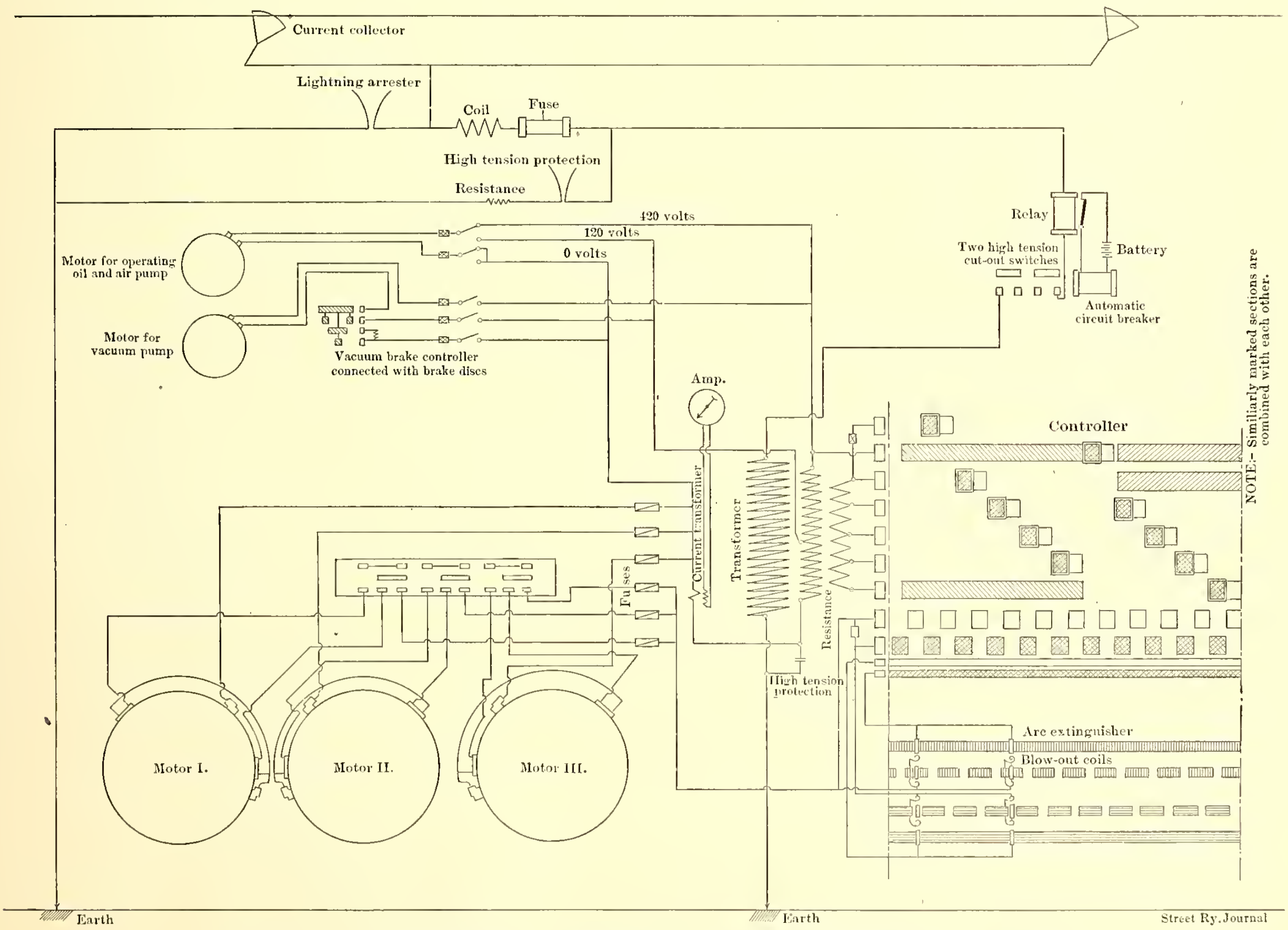
At the Albano station special precautions have been taken to break the circuit in the trolley wire at the station and for a distance on each side. The wiring details of this section insulator are shown herewith. The two switches S, each of which controls one section, can be operated by hand or in such connection with the semaphores that the current is cut off when the semaphore is set for a stop. The other switches,



WIRING CONNECTIONS OF SECTION INSULATOR

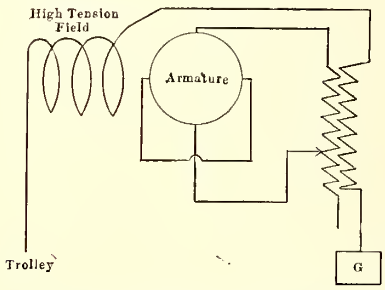
such as A^2, which cuts off current from the station rails, and the emergency short-circuiting device N are only operated by hand.

On the line between Tomteboda and Stockholm it is intended to try out the Huber contact system, made by the Maschinenfabrik Oerlikon, of Zurich, Switzerland. As a regular service has been planned for the Stockholm-Tärfva line, the current-collecting devices will have to be interchanged at Tomteboda, at which place all of the collectors can be placed in contact with the trolley wires. While this involves some complicated wiring at this station, it is justified for experimental work. A telephone system has been installed along the Värtan line which can be put in circuit with car telephones by using a hooked metal pole, as on American railways.



ELECTRICAL CONNECTIONS OF SIEMENS-SCHUCKERT SINGLE-PHASE LOCOMOTIVE

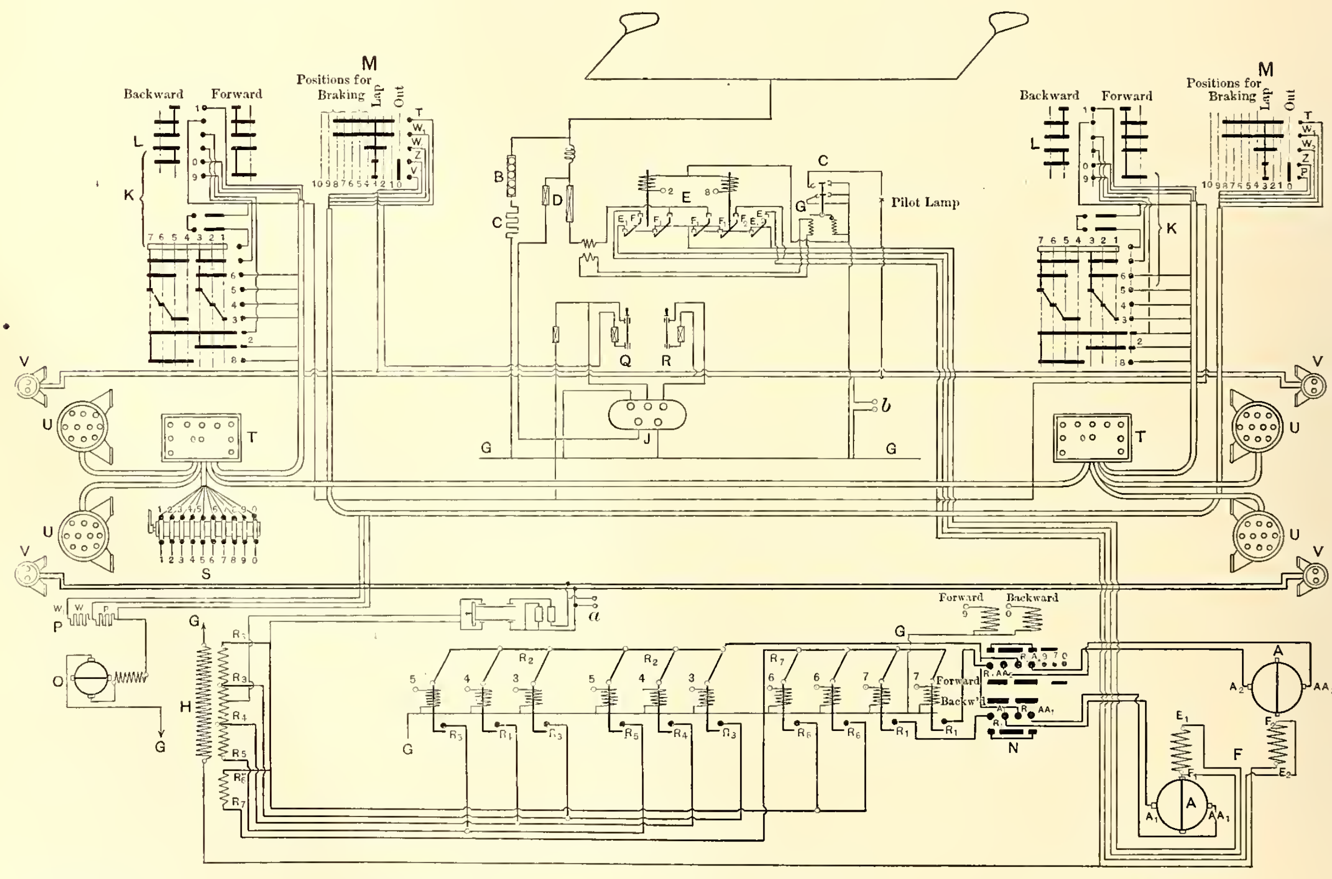
The present experiments are being conducted with two electric locomotives and one multiple-unit train. The Baldwin-Westinghouse locomotive was described in the STREET RAILWAY JOURNAL of April 15, 1905, and the Siemens-Schuckert Locomotive in the issue of Jan. 13, 1906. It may be stated here that the first locomotive, which carries two 150-hp motors, has a draw-bar pull of 4000 kg and hauled loads up to 300 tons on 10 per cent grades on curves of 600-m. radius. The details of the second locomotive, which has a draw-bar pull of 6000 kg, are quite different from the other, which fact will be helpful in reaching some valuable conclusions as to the performance of different types under similar conditions. It will be noticed from the diagram of connections on the previous page that this locomotive has three large motors (110 hp each) for running and one small motor (7 hp) for the vacuum brake system employed.



WINTER-EICHBERG CONNECTIONS WITH STATOR IN PRIMARY CIRCUIT

The multiple-unit train is made up of two motor cars and two trailers equipped by the Allgemeine Elektricitäts Gesellschaft. Each of the former carries two 120-hp Winter-Eichberg-51 single-phase motors. A diagram of the connections of this motor is presented herewith. As will be seen, the stators are arranged to use the line potential. This is one of the principal points of advantage claimed by the manufacturers for this machine. The stator circuit is non-inductive and its apparent resistance varies directly with the speed. In series with the stator field is the primary of a transformer from whose secondary the rotor-operating current is taken. To produce a variation in motor torque it is usually the practice to take current for the rotor from different taps on the secondary of this transformer. In addition to this circuit and its set of brushes, the motor has another set of brushes which set at 90 degs. from the first set and are short-circuited, as shown. This circuit receives its current by transformer action from the stator coils upon which it reacts, and thus produces the effect of the insertion of resistance in the stator circuit.

The controller connections of the motor car are shown below. This diagram is particularly interesting, because several of the manufacturers of single-phase apparatus have announced that the multiple-unit system has been or can be adapted to the control of the single-phase motors, but no complete diagram of the connections or description of the methods to be employed has been published. The Allgemeine Elektricitäts Gesellschaft, as is well known, controls the General Electric patents in Germany and several other Continental countries of Europe, so that its multiple-unit control system is that using electrical contactors and is what is known here as the Sprague-General Electric system, or a modification of it.



A Rotor of motors.
B Lightning arrester.
C Lightning resistance.
D Fuse.
E High tension switch.
F Stator of motors.
G Ground.
H Controlling transformer.
J Transformer for light, compressor and controlling circuits.
K Master controller.
L Reversing cylinder.
M Brake cylinder.
N Reversing switch.
O Motor air compressor.
P Resistance for same.
Q Pump switch.
R Light switch.
S Car switch board.
T Junction box.
U Coupling for controlling circuits.
V Coupler for lighting, pump and heating circuits.
a Heater switch.
b Light switch.
c Pilot lamp circuit.

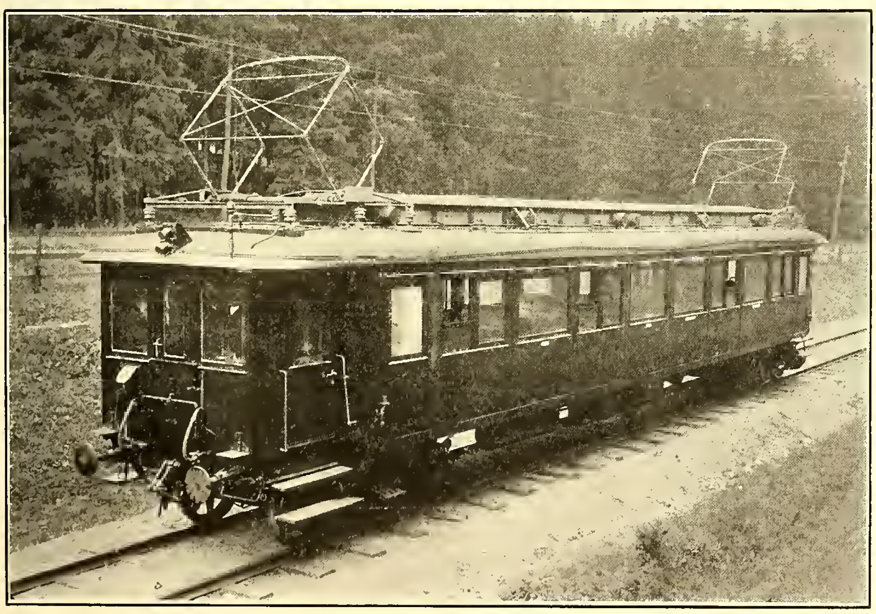
Street Ry. Journal

WIRING DIAGRAM OF THE A. E. G. SINGLE-PHASE EXPERIMENTAL MOTOR CAR FOR THE SWEDISH STATE RAILWAYS

In the diagram herewith the rotors of the car motors with their short-circuiting coils are shown at A and the stators at F. The high-tension circuit starts from the collector A, and is carried to the change-over switch, E, operated by contactors 2 and 8 This switch, as shown by the developed diagram of the controller at the right of the diagram, first connects the rotor field in series, but when notch 4 on the controller is reached it connects them in parallel. From the rotor fields the high-tension circuit leads to earth. Taking up now the controller circuit, assume the circuit-breaker closed and the reverser handle on the forward notch. Then the contactors closed are 2, which connects the stator coils in series, 9, which closes the reversing switch for forward running and 7. Step 1 on the controller operates contactors 3 and 6, by which the rotors are connected to the first tap on the transformer. On steps 2 and 3 contactor 3 is dropped and first 4 and then 5 are thrown in, giving the full series position. Step 4 is not a running point as contactor R 6 is open, while the stator fields are changed from series to parallel at E through contactor 8. Steps 5, 6 and 7 on the controller then gradually increase the voltage in the rotor. The reversing switch is operated by contactors 0 and 9, 9 being for forward and 0 for backward.

Single-phase current is evidently used for operating the contactors. No description of the alternating-current magnets used in the contactors has been published, but it is probable that they are like d. c. contactors with coarser winding and fewer turns to reduce impedance.

Air pressure is employed to actuate the current collectors. The heaters receive practically no current when the motors are carrying full load and a maximum when the motors are taking little current. This is done to equalize the power station load as much as possible. The motors are geared 1:4.26 to give a speed of 45 km (36 miles) an hour, but can also carry gears in the ratio of 1:2.96 to secure a speed of 65 km (52 miles) an hour.



SINGLE-PHASE A. E. G. MOTOR CAR FOR THE SWEDISH STATE RAILWAYS

After thoroughly testing the apparatus delivered for these trials it is planned to carry out the program set forth below.

A. POWER STATION

1. Devices for protecting the generators and transformers against abnormally high potentials and short circuits.

2. Regulation of voltage with changing loads.

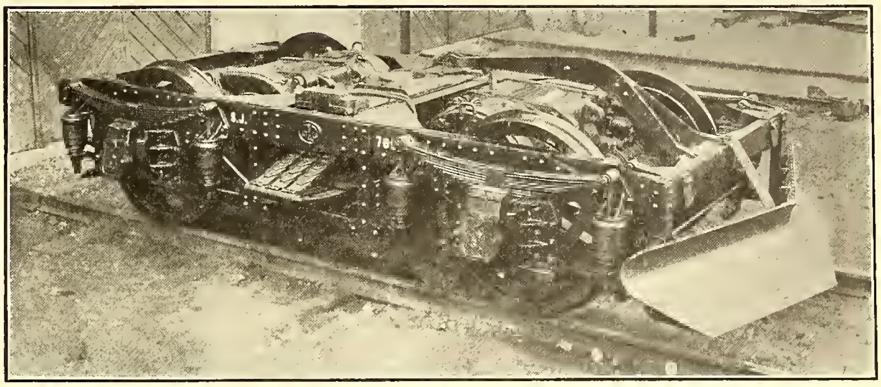
B. ELECTRIC CIRCUITS

1. Various systems, arrangements and details regarding the suspension of the trolley wire in open country, under bridges, in tunnels and at stations.

2. Protective devices to prevent danger or damage from falling high-potential wires.

3. Grade-crossing protection.

4. Division of trolley wire by section insulators to increase safety to the general public at the passenger stations.



TRUCK CARRYING A. E. G. SINGLE-PHASE MOTORS FOR SWEDISH RAILWAYS

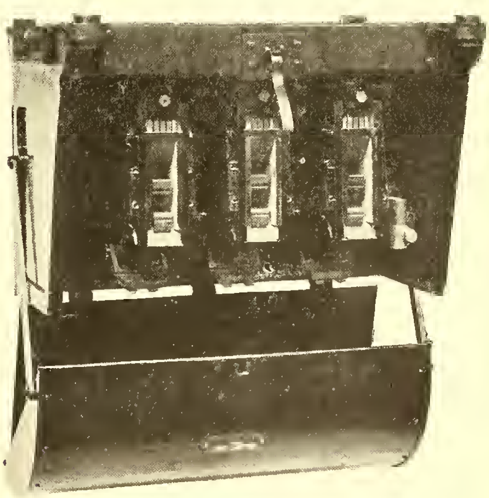
5. Measurements of the impedance of the trolley and rail circuits—the latter also with various forms of rail bonds. Examination of insulation under different conditions.

6. Investigations into the origin of stray currents and means for preventing any damage by them.

7. The influence of the railway currents on telephone and telegraph circuits along the line and means for minimizing such disturbances.

C. ROLLING STOCK

1. The characteristics of the motors in reference to tractive effort and speed; heating and load performance of the motors on long and short runs with and without artificial ventilation; sparking; cutting out of certain parts; overload capacities; the exploitation of the weight of adhesion at different frequencies; efficiency and phase shifting under different loads; acceleration; apparatus between motor and driving axle.



A. E. G. SINGLE-PHASE CONTACTORS ON MOTOR CAR

2. Electric starting and regulating apparatus of different types and arrangements for multiple-unit operation.

3. Various types of current collectors.

4. Measurement of train resistance and power consumption at different speeds and make-up of train.

5. Automatic braking system for electric railways.
6. Electric heating.
7. Electric train lighting.
8. Signal whistles, especially those for compressed-air operation.
9. Arrangement of rolling material to prevent danger to trainmen and passengers from the high-potential wire.

This program will, of course, be extended according to the way conditions develop. The engineering commission which will study the data from these tests is composed of railroad and electrical experts, part of whom are officially connected with the Swedish State Railways, who will also determine upon the most practicable system for the Swedish conditions.

INDUCING LONG DISTANCE BUSINESS

The connecting up of a great many lines in Ohio and Indiana is constantly placing roads in this district in a position to secure much new business from through traffic originated on other lines or going to points on connecting lines. A number of roads are now following schemes worked out by steam railroads for securing such through business. As with steam railroads it is not always the line with the most direct route that gets the through interline business. Frequently the so-called differential road with a longer haul can secure a good proportion of the business by live missionery work in the proper districts and through the proper channels. The Toledo, Fostoria & Findlay Railway, a 35-mile line in Ohio, operating from Findlay to Pemberville, forms part of the most direct route between points in Indiana and Western Ohio and those in Northern Ohio, by means of its connection with the Lake Erie, Bowling Green & Napoleon Railway at Pemberville, which in turn connects with the Lake Shore Electric Railway at Woodville. It is also going after the business to Toledo and numerous points beyond on Toledo interurban lines, although there is a direct line from Findlay to Toledo over a shorter route. The roads mentioned have arranged their schedules to make very close connections, and with union stations at terminals and by a recent reduction of schedules they are enabled to give fair service over a longer route. The Toledo, Fostoria & Findlay has issued basing rate sheets showing rates from its terminal cities to points on a large number of connecting lines. The sheets show the names of connecting lines, the points reached by those lines and rates for single trip and round trip. On the lower part of the sheet are routing instructions showing the roads traversed and junction points of various lines to destination ; of course, in every case, routeing is over the Toledo, Fostoria & Findlay and the rates meet those of the shorter route. These basing rate sheets are sent to agents on other lines throughout the district where there are connecting lines. This enables any agent to sell a through ticket by adding his rate to the Toledo, Fostoria & Findlay terminal city, to the rate to destination named in the folder. The company also distributes a poster giving a map of its line, connecting lines and points reached. These are placed in advantageous positions in hotels and waiting rooms throughout a wide district. One of the sheets is reproduced herewith.

Lima Route

RAILWAY Co

The Western Ohio Railway Co.

Time Table in effect March 5, 1906.

The New Way to Lima.

Leave Tolsdo daily on the T., B. G. & S. Limiteds as follows:

	A.M.	P.M.	P.M.	P.M.
Lv. Toledo....	6:30	12:30	6:30	9:30
Lv. Findlay...	8:17	2:17	8:17	11:17
Lv. Bluffton...	9:03	3:03	9:03	12:03
Ar. Lima......	9:50	3:50	9:50	12:50

A clean, fast ride, free from dust and cinders, landing passengers in the business heart of all cities.

Local T., B. G. & S. trains also make connections. LOCAL trains leave Findlay for Rawson, Mt. Cory, Bluffton. Beaver Dam and Lima svery two hours from 6:12 a. m. until 8:12 p. m., then 11:12 p. m., and connecting with the following trains:

THE FAMOUS LIMA LIMITED

Leavss Lima daily on the Western Ohio Railway, at 8:35 a. m., 11:35 a. m., 2:35 p. m., 5:35 p. m. and 8:35 p. m. for Wapakonsta, Sidney, Piqua, Troy, Springfisld, Tippecanoe City and Dayton, and makes ths run Lima to Dayton, 80 miles, in 150 minutes, without changs or excess fare.

LOCAL TRAINS

Leavs Lima hourly from 6:13 a. m. to 8:13 p. m. for Cridersville, Wapakoneta, St. Marys, Celina, New Bremen, Minster, Botkins, Anna, Sidney, Piqua, Troy, Tippecanoe City, Springfield and Dayton; at 10:13 to St. Marys, only; 11:40 to Wapakoneta.

NEW FREIGHT ROUTE.

Quick Service. Careful Handling.

Toledo to Rawson, Mt. Cory, Bluffton, Beaver Dam, Lima, Cridersvills, Wapakoneta, St. Marys, Celina, Minster, Bremen, Anna, Botkins, Sidney, Piqua, Troy, Springfield, Dayton, Delphos, Van Wert, Convoy, Monroeville, New Haven and Ft. Wayne.

USE THE ELECTRIC ROUTE.

A TYPICAL NEWSPAPER ADVERTISEMENT

It is unusual for an electric line to advertise in the daily papers of cities which it does not touch with a view to inducing traffic to come to it over connecting lines. This is being done by the Western Ohio Railway in its efforts to cultivate the through business between Toledo, Dayton and Cincinnati and between Fort Wayne, Dayton and other points. The accompanying advertisement is now appearing in Toledo daily papers, 50 miles from the northern terminus of the Western Ohio, and similar advertisements are being carried in Fort Wayne papers, 65 miles from Lima. It gives the times of limited trains on the Toledo, Bowling Green & Southern Railway which connect with Western Ohio trains at Findlay and the times of departure of limited trains from Lima which run to Dayton and make connection for Cincinnati and Columbus; also the times of the slower local trains and an outline of the possibilities for through freight shipments to a great number of towns over the same routes. These live advertising methods should yield considerable new business.

BASING RATE SHEET

To Points Reached by

The Toledo, Fostoria & Findlay Railway

from

FINDLAY, OHIO

Ticket agents are requested to sell through tickets via this line whenever possible.

F. W. ADAMS, General Manager
R. S. POWLEY, General Passenger Agent

APPROVED FOR USE OF TICKET AGENTS.

Passenger Rates from Findlay, Ohio, via The Toledo, Fostoria & Findlay Railway

T. F. & F. Ry.	S. T.	R. T.
ARCADIA	$.15	$.25
REEVES PARK	.15	.25
FOSTORIA	.30	.50
LONGLEY	.40	.65
RISINGSUN	.45	.75
BRADNER	.50	.90
PEMBERVILLE	.65	1.10

T. F. & E. Ry.	S. T.	R. T.
BASCOM	.45	.75
TIFFIN	.60	1.00

L. E. B. G. & N.	S. T.	R. T.
BOWLING GREEN	.75	
WOODVILLE	.80	1.40

L. S. Electric Ry.	S. T.	R. T.
BELLEVUE	1.25	2.30
BERLIN HEIGHTS	1.65	3.05
BERLINVILLE	1.60	3.00
CLEVELAND (City Limits)	2.35	4.35
CLYDE	1.15	2.10
FREMONT	1.05	1.90
GENOA	.85	1.50
GIBSONBURG	.95	1.70
HESSVILLE	.90	1.60
HURON	1.80	3.30
LORAIN	1.95	3.60
MONROEVILLE	1.35	2.50
NORWALK	1.45	2.70
SANDUSKY	1.70	3.20
VERMILLION	1.85	3.40
TOLEDO	1.00	

D. M. & T. S. L. Ry.	S. T.	R. T.
DETROIT, Michigan	1.80	
WYANDOTTE, "	1.75	
TRENTON, "	1.65	
ROCKWOOD, "	1.55	
NEWPORT, "	1.45	
MONROE "	1.30	

T. & W. Ry.	S. T.	R. T.
SYLVANIA, Ohio	1.20	
METAMORA, Ohio	1.43	
MORENCI, Michigan	1.75	
FAYETTE, Ohio	1.90	
ALVORDTON, Ohio	2.03	
PIONEER, "	2.15	
BLISSFIELD, Michigan	1.45	
PALMYRA, "	1.55	
ADRIAN, "	1.65	

T. Pt. C. & L. Ry.	S. T.	R. T.
ELMORE	.95	1.65
OAK HARBOR	1.10	1.95
PORT CLINTON	1.35	2.40
GYPSUM	1.45	2.55
DANBURY	1.50	2.65
LAKESIDE	1.60	2.85
MARBLEHEAD	1.60	2.85

T. & I. Ry.	S. T.	R. T.
HOLLAND	1.20	
SWANTON	1.40	
DELTA	1.55	
WAUSEON	1.70	
PETTISVILLE	1.80	
ARCHBOLD	1.90	
STRYKER	2.00	
BRYAN	2.15	

ROUTING INSTRUCTIONS

From Findlay to points on

The Toledo, Fostoria & Findlay Railway Co. — One coupon to destination

The Lake Erie, Bowling Green and Napoleon Ry. Co. — T. F. & F. to Pemberville; L. E. B. G. & N. to destination

Lake Shore Electric — T. F. & F. to Pemberville; L. E. B. G. & N. to Woodville; L. S. Electric to destination

From Findlay to points on

Toledo, Port Clinton and Lakeside Railway — T. F. & F. to Pemberville; L. E. B. G. & N. to Woodville; L. S. Electric to Genoa; T. Pt. C. & L. to destination

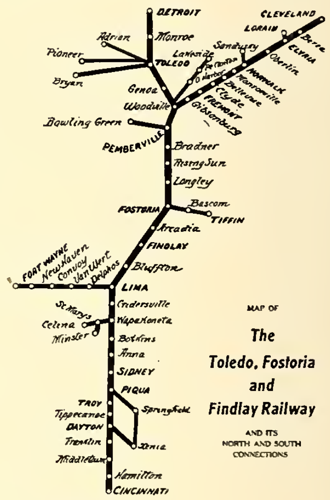
Tiffin, Fostoria & Eastern Electric Ry. Co. — T. F. & F. to Fostoria; T. F. & E. to destination

From Findlay to points on

Detroit, Monroe and Toledo Short Line Ry., Toledo and Indiana Railway, Toledo and Western Railway — T. F. & F. to Pemberville; L. E. B. G. & N. to Woodville; L. S. Electric to Toledo,—and terminal line Toledo to destination.

Union Station with Western Ohio at Findlay.

No transfer at any junction point to the above routes.



THE FOUR PAGES OF A RATE-SHEET CIRCULAR PUBLISHED BY THE TOLEDO, FOSTORIA & FINDLAY RAILWAY

DRYING SAND FOR SANDING RAILS IN THE BOROUGH OF MANHATTAN

BY W. BOARDMAN REED

The conditions existing on the streets and avenues in the Borough of Manhattan, City of New York, are such that for the operation of surface cars large quantities of sand are used on the rails. The conditions existent are due to the congestion, which compels much of the vehicular traffic to follow the tracks and to the droppings of horses, which, combined with the water from the sprinkling of streets, all tend to form a sticky, slippery substance that results in "bad" rail, since, on account of the high buildings, the rays of the sun do not reach the tracks to dry them off. This is especially true of such streets and avenues as have elevated railroads over them, where the surface of the street is always shaded. This shading of the streets makes the rail especially bad in foggy or muggy weather.

Were it practicable to keep the rails thoroughly washed, the difficulty mentioned could be overcome. Indeed, experiments made by the Department of Street Cleaning of the City of New York, in the sprinkling of streets with water under pressure have demonstrated that this method of overcoming the trouble in question is feasible. However, the expense to the street railway company to clean its rails in this way would be prohibitive.

Cars having chilled cast iron wheels are found to be more affected by the slippery condition of the rail than are those with steel wheels.

To guard against accidents and to expedite the starting of cars, sand boxes, under the control of motorman, are provided on each passenger car. In addition, whenever conditions require it, sand cars are operated which sprinkle a small amount of sand on one rail only. In some localities in Manhattan Borough it is necessary to operate sand cars almost continuously.

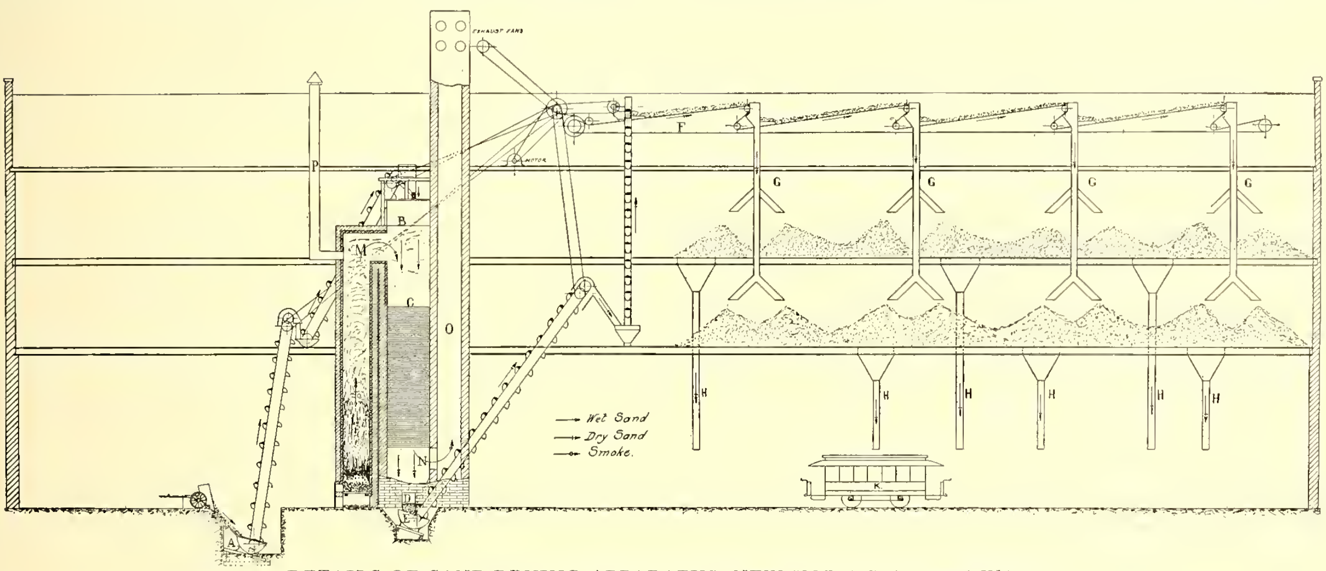
It was found that the use or ordinary screened bank sand, especially if too coarse, tended to flatten the wheels of cars and, therefore, no attempt was made to obtain sand boxes that would handle this kind of sand. A fine sand, exceedingly sharp, was sought, and finally found, that which is used being obtained by dredging in Long Island Sound, near the shore, about 30 or 40 miles from Hell Gate. The material dredged is screened and various products are obtained therefrom, namely: First, cobbles; second, pebbles, about 1½ ins. in diameter, used for concrete; third, paving gravel; fourth, roofing gravel; fifth, grits, which refuse a screen with 100 meshes to the square inch; and, sixth, the sand which passes through a screen of this mesh.

As the screening is done with water, all fine material which, if dry, would form dust, is washed away, and the resulting product is exceedingly sharp and clean.

This sand is brought by scows to Manhattan and, when received, is usually saturated with water. It is, therefore, essential that this sand be dried before being used, and it has been found economical to thoroughly dry not only the sand which is used in the sand boxes on the cars but that which is used in the sand cars as well. The sand cars are arranged with a valve controlled by the motorman, as on the passenger cars, and the sand, being so fine, when dry, will readily flow through a small aperture, so that a very small amount is used.

For the drying of this sand, a bin fitted with steam pipes was first tried, but it was found that this was an exceedingly slow and expensive method of handling the matter. Sand-drying stoves, known as "The Clark Perfect Sand-Dryer, No. 1," manufactured in Chicago, Ill., were then tried and used for some years. These are practically cylindrical stoves, surrounded with a conical sheet iron hopper. The wet sand shoveled into the hopper comes in contact with the hot surface of the stove and dries, then running through small holes at the bottom of the hopper. Where only small quantities of sand are used, this method of drying would seem to be as economical as any, and is, generally speaking, satisfactory. If, however, the capacity of sand-dryers of this type are overtaxed and a hot fire used, the overheating of portions of the sand destroys its efficacy. Then, sand thus dried must be handled by hand several times, and the cost for fuel used too is considerable. Furthermore, in drying there must necessarily be a circulation of air and with this method the only circulation obtained is that caused by the rising of heat through the sand, so that the circulation obtained is very sluggish.

With the increase of mileage of electric lines in Manhattan Borough, the expense of sand became an item of considerable importance and the writer became convinced that some more economical method should be adopted. An investigation of the various types of dryers used led the writer to adopt a gravity dryer, with forced circulation of air, so arranged that all heat from the fuel should come in direct contact with the sand, but only at such a temperature as was necessary,



DETAILS OF SAND-DRYING APPARATUS, NEW YORK CITY RAILWAY with the aid of the circulating air, to remove the moisture therefrom. The object sought was not to raise the temperature of the sand above 150 degrees F. Dryers of this character are used in drying magnetite for magnetic separation; also by plaster mills for the drying of sand. The writer, however, made some modifications from any arrangement that he has seen in use.

The first one of these machines built by the writer was erected at Ninth Avenue and Fifty-Fourth Street, in the spring of 1903. The available space being limited; and the machine being of an experimental nature, only a small dryer was erected. It was found that with the single stack first constructed about 75 cubic yards of sand could be dried in a day of ten hours. At this plant it was arranged to store the wet sand on the first floor, about level with the street, the bin used for storage being about 25 ft. wide and 150 ft. long, and the sand being piled about 12 ft. high in this bin. A tunnel, 5 ft. wide and 5 ft. deep, was built under the floor of this bin, in which was operated a 12-in. belt conveyor. Through holes about 6 ins. square in the floor of the bin, sand was drawn from the bin above to this conveyor, which deposited it in the elevator boot. From this point it was then carried to the top of the dryer. Passing down through the so-called slat chamber, the dry sand ran into the elevator boot, whence it was carried to the dry sand bin, located on the second floor over the car house, adjacent to the wet sand bin. The dry sand bin was about 25 ft. wide by about 125 ft. long and was built to carry sand piled 8 ft. deep. In its center was a 12-in. belt conveyor, so arranged as to distribute the sand. Through the floor of this bin were chutes, controlled by valves from below, through which sand was loaded into sand cars. In general, the details of this dryer were the same as those of the dryer erected at Sixty-Fifth Street and Second Avenue, which is described and illustrated later.

The results obtained warranted the erecting of an additional slat chamber and dry sand bin, together with the necessary elevating and conveying apparatus, and this was done in 1904. Unfortunately, this additional machine had been in operation only a few weeks when a large portion of the building was destroyed by fire. The dryer is still in operation, but the facilities for loading dry sand into cars are not as good as formerly. As stated, the single stack, as first built, would dry about 75 cubic yards of sand in ten hours, the expense of so doing being as follows, including all necessary handling of sand from the wet sand bin into cars:

1 Foreman..............................	at $2.50	$2.50
2 Laborers..............................	at 1.50	3.00
½ gallon oil..............................	at .50	.25
1 ton coal..............................	at 3.00	3.00
Power, 20 hp................	at $.0225 per hp h.,	4.50
		$13.25
Interest on $5,000...................... $250.00		
Depreciation and repairs, $500; equals $2.00 per day,		2.00
		$15.25

making the cost for handling and drying $.2033 1-3 per cubic yard of sand.

After the additional stack was added, the cost per yard was decreased, this, together with other changes made, bringing this cost to about $.18 per cubic yard of sand.

The figure last mentioned does not include any allowance for rental for the space occupied, which would be approximately the same, no matter what system of drying was used.

Although the dryer at Fifty-Fourth Street and Ninth Avenue was able to handle in the aggregate a quantity of sand equal to the total amount used, yet it was not conveniently located for serving all the lines of the system. Hence, in 1905, an additional plant was erected on Second Avenue, between Sixty-Fifth Street and Sixty-Sixth Street. The building used was formerly a boiler house, with coal storage bins on the second and third floors. These bins were utilized for sand storage and had a capacity of about 5500 cubic yards.

The arrangement of the drying machinery and storage bins and the method of distribution at the plant located at Second Avenue and Sixty-Fifth Street are shown in the diagrams. The wet sand is hauled from the river front to the ground floor of the building, where it is dumped from carts direct into the elevator boot, "A." From this it is carried by elevators to the top of the dryer and dumped into the hopper, "B," located at the top of the slat chamber. The slat chamber is about 8 ft. square and the hopper is located about 58 ft. from the ground floor. The sand then falls through the space between the hopper and the slats at "C," a distance of about 15 ft. These slats consists of T irons, about 3½ ins. x 2½ ins. in size, and are placed 6 ins. between centers, with the leg upward, the rows being situated about 6 ins. apart, vertically. Further, in placing the slats care is taken to stagger them. The sand, therefore, falling upon the top row, is diverted to the row beneath, and so the successive rows are reached until the sand falls into the chamber below and passes through the opening in the bottom of the slat chamber, at "D," where is located a valve to control the speed of flow.

Adjacent to the slat chamber is the fire chamber, or flue, in size about 5 ft. x 8 ft., inside, the grate being the full size of the flue. The heated gases pass upward from the grate through this flue and through the opening into the slat chamber, at "M," mingling with the wet sand in this slat chamber on its way through the slate, the gases passing out through the opening at the bottom into the flue "O." From this latter point the gases are drawn upward by exhaust fans, located at the top of this flue, four 48-in. exhaust fans, running at a rate of about 600 r. p. m., being used for this purpose.

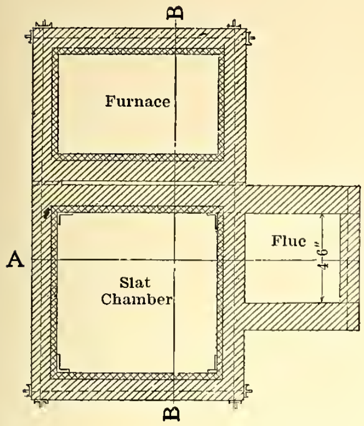
The dry sand, running through the opening "D" to the elevator boot, "E," is carried to the belt conveyor, of the Robins type, located above the roof of the building. From the conveyor it is distributed through various chutes to the storage bins located on the second and third floors of the building. From these bins the sand can be drawn through chutes to sand cars located on the ground floor of the building.

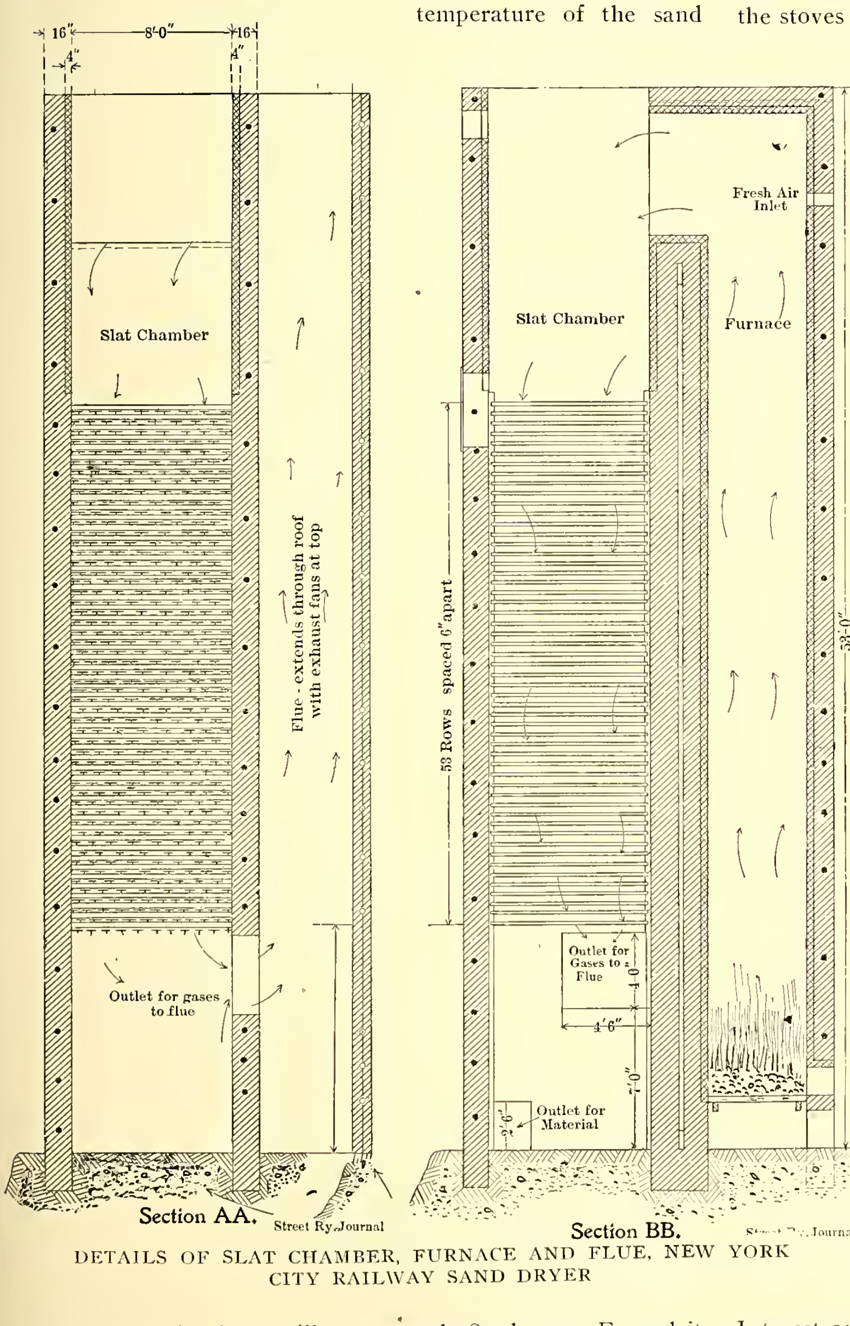
As above stated, the building used at Sixty-Fifth Street and Second Avenue was exceptionally well adapted for the storage of sand, on account of its having been constructed with the second and third floors designed for cold storage. Dry sand weighs approximately 100 lbs. to the cubic foot, and the floor of this building having been constructed to carry safely 700 lbs. to the square foot, the sand can be piled to a height of about 7 ft. in the storage bins. There is storage capacity in this building for about 5500 cubic yards of sand.

In building the fire chamber, an opening was left near the top of the flue, "P," which is utilized when the blowers are not in operation to carry off the gases. When the blowers are in operation, the opening is used for the supplying of cold air, the amount being regulated by a damper.

The difficulty in the using of this character of dryer has been the feeding of sand into the slat chamber. In this machine a rocking grate is used, located at the top of the chamber and consisting of 2¼-in. square steel bars, rounded at the ends, to which levers are fastened which are operated by eccentric on the shaft. The speed of flow of sand can be regulated by the amount of throw of these levers, or by the speed with which they are operated.

As the drying of any substance depends not only upon the heated air coming in contact with it, but especially upon the circulating of heating air through it, arrangements were made by means of exhaust fans to draw a large volume of air through the sand. The arrangement of this dryer causes the hottest air to come in contact with the sand when it contains the most moisture and though the latter is drawn down with the sand, yet there is sufficient heat in the sand as it falls to the bottom to cause this slight amount of moisture to evaporate. The supply of cold air and the amount of fire should be so regulated that the temperature of the sand





DETAILS OF SLAT CHAMBER, FURNACE AND FLUE, NEW YORK CITY RAILWAY SAND DRYER

as it leaves the dryer will not exceed 180 degrees F., and it is better to keep it at 150 degrees F. Care should be taken, however, to have a sufficient volume of heated air passing through the sand to carry off all of the moisture.

The dryer shown on the diagram has, as stated, a fire chamber 5 ft. x 8 ft., a slat chamber, 8 ft. sq. and a flue, 4 ft. 6 ins. sq., for carrying off heated gases.

It is quite important that as much height be obtained between the top of the slat chamber and the bottom of the slat chamber as is practicable. In this case there is a fall, as stated, of about 58 ft.

It has been found that the machine at Sixty-Fifth Street and Second Avenue is of sufficient capacity for the drying of from 250 cubic yards to 300 cubic yards of saturated sand in ten hours; the conveying machinery, however, was designed to handle only 20 cubic yards of sand per hour. It has been found that the apparatus will very easily dry 225 yards of sand in a day of between nine and ten hours, provided that the fire has been started and the blowers run for a sufficient time to get the surfaces of the chamber warmed up before the wet sand is started through it.

The comparative results obtained by this dryer and by using the stoves are as follows:

DRYING WITH STOVES

Cost of sand at the dock, per yard......	$ .90
Cost of hauling sand to storage bins and trimming	.30
Cost of drying and loading into sand cars	.515
Cost of sand per cubic yard, dried....	$1.715

DRYING WITH SIXTY-FIFTH STREET DRYER

Cost of sand at the dock per yard.......	$ .90
Cost of hauling to dryer................	.225
Cost of drying and loading............	.145
Cost of sand per cubic yard, dried....	$1.270

A portion of this difference is caused on account of our being able to haul the sand from the boat direct to the dryer, rather than place it in storage and so have to handle it the second time, and, again, by better facilities in this plant for the loading of sand cars.

The labor and material necessary for the operation of a bank of four stoves, operating 24 hours per day and drying approximately 24 cubic yards of sand, was found to be as follows:

4 men, working 12 hours each, at $ .15 per hour............................	$7.20
½ ton egg coal, at $4.50 per ton	2.25
Interest, depreciation, etc................	.50
	$9.95

The force and material necessary for the operation of the sand-dryer at Sixty-Fifth Street and Second Avenue is as follows:

1 foreman..........	at $2.50 per day..	$ 2.50
1 oiler.............	at 2.00 per day..	2.00
1 fireman...........	at 1.75 per day..	1.75
2 laborers..........	at 1.50 per day..	3.00
4 tons coal.........	at 3.00 per ton..	10.00
Oil, grease and waste..................		1.00
40 hp of current......	at .0225 per hp..	.90
		$23.15
Interest and depreciation..........................		6.00
Total,		$29.15

An estimate based upon the drying of 200 cubic yards of sand per day makes the total cost per cubic yard $1.45.

The entire conveying and elevating machinery, together with the exhaust fans, is operated with a 50-hp GE motor, although an average of less than 40 hp will be used during the ten hours that the machine is in operation.

The elevating and conveying machinery used was furnished by the Robins Conveying Belt Company, of New York City, but was erected by the New York City Railway Company.

The amount of sand used on the surface lines in the Borough of Manhattan is about 15,000 cubic yards per annum.

The cost of installing the plant was about $25,000. Of this the elevators and conveyors cost $6,000, the dryer $15,000, the erection of the conveyors, etc., $2,000, the motor $600, and the enclosure for the conveyors, etc., and other necessary changes in building, $1,400.

THE CONDITION OF THE AIR OF THE RAPID TRANSIT SUBWAY*

BY GEORGE A. SOPER, Ph.D.

It is my intention to-night, with the courteous permission of the Board of Rapid Transit Commissioners, to bring to your attention some of the most interesting and significant results of a six months' investigation of the condition of the air of the New York Subway. The Board of Rapid Transit Commissioners is, as you know, the body which has had official charge of the construction of the road. Under their supervision several hundred million dollars worth of additional subways are yet to be built. The main object of the investigation was to determine whether any harmful matters or conditions existed in the subway to such an extent as to make the air in any degree a menace to the public health. The methods employed depended largely on the use of chemical and bacteriological analyses. I was not authorized to examine into the health of the employees, although to have done so might have proved an important feature of the work. The investigation began in July and ended in December. There was thus afforded an opportunity for observing the conditions during different seasons of the year.

TEMPERATURE

For about a year, now, the overheating of the subway has been a matter of so much public interest that our attention may well be directed to the question of temperature first. The overheating first became noticeable in the middle of March, 1905. At this time, according to the records of the preceding year, the temperature inside and outside of the subway should have been about the same, but it was warmer. As summer came on, the subway air remained warmer than the outside air when it should have been cooler.

Before the subway was opened, its temperature during its hottest week was 18.3 degs. Fahr. cooler than the air in the streets. After it was opened its average temperature during its hottest week was 5.2 degs. warmer than the outside air. The average of the daily temperatures noted in the subway during this week was 83.4 degs. The maximum temperatures observed in the subway during this hottest week was 88.2 degs. In the street it was the same at the same time. The coldest temperature observed by me in the subway during the present winter was 30 degs. This occurred at the Canal Street station. It was 16 degs. warmer here than in the streets.

So far, the difference between the temperature of the subway and streets has been much less in summer than in winter. In July and August, 1905, the average temperature of the subway was 5.6 degs. higher than that of the streets, but in the first part of November the difference was over 15 degs. In the middle of November, the routine work of collecting and interpreting the records of temperature was turned over by me to the engineers of the road and I have no knowledge of the general averages since.

In view of the fact that European subways appear to become warmer year by year, the increasing excess of temperature of our subway over the outside air, as noted by me up to last November, leads me to look forward to the possibilities of the coming summer with peculiar interest.

The cause and remedy for the overheating of the subway are being made the subject of study by the Chief Engineer of the Board of Rapid Transit Commissioners, George S. Rice. If his work is successful, and we all trust that it may be so, we may have a cooler, rather than a warmer, road next summer. In consequence of the comprehensive work which I am informed Mr. Rice is carrying on in this direction, it seems inappropriate for me to discuss this phase of the subject further to-night.

EFFECT OF HEAT

Sanitary considerations do not lead me to regard the heat of the subway, as shown by last summer's figures, with alarm. It is difficult to see how the higher temperatures which have occurred at this season could alone produce injurious effects upon health. But if the heat is not unhealthy, it is at least disagreeable, and if it proves to be a practical undertaking, the subway should by all means be kept cool. In hot weather the subway is most uncomfortable in the morning and at night. At these times, the air does not cool off as does the air in the streets. In the most tightly closed portions of the subway, the temperature remains nearly constant through the twenty-four hours. Some stations are always warmer and more even in temperature than others. Express stations generally become overheated and cool more rapidly than local stations. As a rule, those places which are most open to the outside air respond most rapidly to changes of temperature in the streets and have, on the whole, the lowest average temperatures.

The conditions in winter, when strong draughts of cold air enter the stations, seem far more apt to prove injurious to health than the conditions in summer. In the winter the temperature of the air near the entrances at some of the stations changes so rapidly that the most sensitive recording thermometers are far too slow to record them.

By means of a very delicate, ventilated thermometer, made especially for the purpose, some idea of the rapid rises and falls was obtained. In one case, when the subway air was 59.5 degs., a drop of 12.5 degs. was noted in less than one minute and a half. In another case, a change of 7 degs. occurred in one minute. Still greater and more rapid variations than these undoubtedly took place but the mercury in even this very sensitive thermometer was too slow to show them.

Leaving now the question of temperature, we may direct our attention for a moment to the subject of humidity.

HUMIDITY

During the period covered by my investigation, the subway air has been practically as dry as the air of sheltered places in the streets. The dew point, that is, the temperature at which moisture begins to condense from the atmosphere, has been, on the whole, little higher inside than outside, but the relative humidity, or degree of saturation, has been lower in the subway than in the streets. In other words, there has really been a little greater weight of water in the air of the subway than in that of the streets, but, because of the higher

* Abstract of paper presented before the New York Academy of Medicine, on March 15, 1906.

temperature, the subway air has not been so nearly saturated.

The average relative humidity of the subway for July and August, 1905, was 57.5 per cent and of the outside air 60.6 per cent. The greatest average humidity for any week in the subway happened to occur during the week which was also the hottest. The average humidity for this period was 64.8 per cent. As a rule, changes in the dew point and relative humidity in the subway followed similar changes out of doors.

At no time has there been a pronounced fog or mist. A fine haze has not been uncommon. This has been most noticeable where shafts of sunlight have penetrated the atmosphere. This haze has been due to dust, not to moisture.

OXYGEN

Chemical analyses were made of the air to determine, first, whether there was a sufficiency of oxygen present, and, second, to what extent the air was vitiated by the products of respiration. All the air examined chemically was collected in special receptacles made for the purpose. It was usually analyzed on the day on which it was collected, or the day after. Samples were taken at stations, and between stations, and at different times. For purposes of comparison, samples of air were usually collected in the streets whenever samples were taken in the subway.

It is interesting to note that my results resemble a similar, though smaller, series of analyses made by Professor C. F. Chandler, of Columbia University, and presented to the City Department of Health a few months after the subway was opened for travel. The conclusions which Dr. Chandler drew from his analyses and the opinions which I have formed from my investigation are similar, so far as purely chemical considerations are concerned.

About eighty oxygen determinations were made for the Board of Rapid Transit Commissioners. The results were remarkably uniform. The difference between the greatest amount found out of doors and the smallest amount found in the subway was .7 per cent. The average for the subway was 20.6 per cent by volume, and for the outside air 20.71 per cent.

One of the most instructive lines of investigation was that involving determination of carbon dioxide. Analyses of air for this produce of respiration are useful because they afford the best index which science has yet discovered of the presence of other and perhaps injurious matters. All air contains carbon dioxide, but the amount in the free, outside atmosphere is small and comparatively constant as compared to the amount generally found in enclosed places occupied by human beings. The difference between the amount found in the subway air and in the air of the streets was an indication of the relative purity. The number of these analyses exceeded 2000. They were probably accurate to about 3-100 of one volume in 10,000 volumes of air. It was necessary to make the carbon dioxide determinations with great precision because the amount was very small. So far as I am aware, this is the largest number of carbon dioxide determinations of equal delicacy ever made in connection with a practical problem of ventilation. The results obtained confirmed the conclusions drawn from the oxygen determinations already alluded to. At no time and at no place was the amount of carbon dioxide large. The greatest amount was 8.89 volumes in 10,000 volumes of air. This was in the tunnel under Park Avenue, near the Grand Central Station, on Dec. 27, 1905, at 6.02 p. m.

It would be interesting, if time permitted, to consider some of the many facts which a careful study of the results of the carbon dioxide analyses has yielded. We should see that the amount fluctuates in the subway at different hours of the day and night, and that even in the streets, there is a daily, and perhaps seasonal, variation in the amount of carbon dioxide present.

It may be a surprise to many to know that when the trains are moving the air circulates not only in and out of the subway but from station to station with remarkable freedom, and that there is but little more carbon dioxide in the air between the stations than at the stations themselves. So great was the ventilation caused by the movement of the trains, especially the express trains, that the effects produced by large centrifugal fans and other ventilating devices experimentally employed to assist the ventilation were entirely hidden.

BACTERIAL ANALYSES

Studies were made of the numbers of bacteria in the air of the subway and the air of the streets. The bacteria were collected by allowing them to settle from the air, as dust would settle, upon circular culture dishes and by filtering them from the air by means of a pump and sand filters. On being taken to the laboratory, the bacteria were incubated in a jar at the temperature of the body for forty-eight hours. The colonies of bacteria which became visible in this time were then counted, growths of molds being considered separately. These methods proved admirably adapted to the large number of observations desired and gave a fair idea of some of the most important things to be known about the subway. About 3000 bacterial analyses were made in all.

There were, according to averages of the results, slightly more than twice as many bacteria found in the air of the streets as in the air of the subway. During, and immediately after, rain there were, as might be expected, fewer bacteria outside than inside, but the number increased outside a day or so after rain and was greatly influenced by the force of the wind. The grand average of all the results obtained with plate exposures was 500 bacteria for the subway against 1157 for the streets. Owing to the fact that the dishes had an area of 1-13 of a square foot, these figures represent the number of bacteria which settled upon a square foot in a minute and were subsequently counted. The average number of bacteria found by filtering the air through sand filters was 3200 per cubic meter in the subway and 6500 in the air of the streets. It is interesting to note that the two methods agreed closely in the relation which they showed between the numbers in subway air and street air.

Little attempt could be made in the Rapid Transit investigation to identify the different kinds of bacteria and molds.

By careful collating and studying the notes which were made when the bacteria were collected for numerical analysis, and giving due weight to other considerations, I have arrived at the provisional conclusion that most of the bacteria in the subway probably came from the streets. My principal reasons for holding this view are as follows:

The numbers of bacteria in the air of the subway varied with the numbers in the air of the streets.

The bacteria were more numerous in the subway near the stairways than at the ends of the stations.

Dirt containing large numbers of bacteria was often seen to be carried down the stairways into the subway by the inrushing currents of air. This dirt contained far more bacteria than the dust which was of subway origin.

The bacteria were more numerous on the side of the stations into which the wind blew from the street than on the opposite side.

There were more bacteria at the ends of the station platforms where the trains departed than at the ends where the trains arrived.

But, although it seems likely from these reasons that most of the bacteria in the air of the subway are derived from the streets, there is excellent ground for concluding that some, and among them the most objectionable kinds, are due to the presence of people, particularly in coughing, sneezing and spitting. Against the dissemination of bacteria by the first two of these acts no restraint seems practicable. People cough and sneeze in one another's faces at short range and probably will do so until that distant day when high ideals of personal hygiene become a common possession. Here lies, undoubtedly, the greatest danger of subway travel, so far as bacterial diseases are concerned. Pollution from the spitting habit is wholly preventable, and in my report to the Rapid Transit Commissioners strong objection has been made to the lack of enforcement of the city ordinance against spitting.

This topic is so closely related to the larger subject of the kind of care which is, in my judgment, necessary for a proper sanitary maintenance of the subway, that I shall deal with it in connection with the broader question.

SANITARY ADMINISTRATION

In my final report to the Rapid Transit Board, dated Feb. 1, 1906, I criticised the sanitary condition of the stations and toilet rooms, as well as of the ballast at many of the stations which has served as the receptacle for unlimited quantities of filth of the kind usually consigned to cuspidors. In my preliminary report to the Board, submitted Oct. 19, 1905, I also recommended that the ballast of the roadbed should be renewed at the stations, or better, replaced with a smooth, concrete surface which could easily be kept clean.

The suggestions made by the Advisory Board of the Board of Health with respect to the cleaning and care of the road were strongly recommended for adoption. A copy of these recommendations for the care of the subway was appended to my preliminary report. They seem so excellent and practical that I will repeat them here:

The Stations.—In sweeping the station platforms and stairs of the subway, properly moistened sawdust and hair brooms should always be used. Dry sweeping should never be permitted. Suitable receptacles should be provided for the fresh and for the used sawdust, and the latter should be carried off every day.

The chief cleaning of the stations should be at night, immediately after the theater crowds have gone home. At this time the stairs, station platforms and closets should not only be swept, but also thoroughly and properly mopped. They should all be scrubbed at least once a week, at night.

The sinks, urinals and closets should be cleaned with utensils kept for that purpose at least twice daily, and afterward treated with efficient disinfectants.

Dusting of the stations should be done only with moist cloths, which should be properly cleansed after each using. The use of feather dusters should not be permitted, either in the stations or cars.

At least four spittoons, raised from the platform and containing sawdust, should be placed in each station. These should be cleaned and disinfected twice daily.

Suitable placards forbidding spitting on the stairs and platforms should be hung in conspicuous places in every station.

One receptacle for papers, plainly labeled, should be placed in each station, and should be emptied daily.

The porters and others in charge of the cleaning of the subway stations should receive precise instructions as to their duties and should be obliged to follow, in every particular, the methods laid down for cleaning and disinfection.

The Cars.—The cars at the cleaning yards after sweeping should be closed, and after not less than 3 hours should be cleared of the dust which has settled. This should be removed from the seats and woodwork by dry or moist cloths, frequently renewed, and from the floor by large moistened mops repeatedly rinsed in fresh water. Thorough scrubbing of the floors of the cars should be done at intervals to be determined by experience.

A Sanitary Supervision.—There should be a special officer of the Interborough Company, expert in modern sanitation, whose duties should be not only to advise as to the methods for maintaining proper sanitary conditions in the subway and its cars, but who should be held responsible also for the proper execution of the methods adopted.

The Roadbed.—It is recommended that the roadbed in front of the platforms between and at the sides of the rails should be made smooth by asphalt or some other material, which can be properly cleaned. The remainder of the roadbed in the underground portions of the road should be treated with some non-inflammable material which will catch and hold the dust which may settle upon it so that it will not be driven into the air by the passage of trains.

It is but just to say that the company which operates the subway does a good deal of work to keep the subway clean and orderly. My objection is that the work is not sufficiently well done. Probably the aggregate weight of dirt and rubbish removed from the stations and cars has amounted to many tons per month. But this amount could probably have been multiplied had the work been more systematically and intelligently done.

SUBWAY DUST

The dust of the subway was made the subject of special study from chemical, physical and biological standpoints. Chemical analyses of the dust showed that it contained 61.38 per cent of iron, nearly all of which was in the metallic state. There were also 21.94 per cent of organic matter, consisting of particles of animal and vegetable origin, 15.58 per cent of silica and other matters insoluble in acid, and 1.18 per cent of oil. The average of a considerable number of determinations of the weight of dust suspended in the air was 61.6 milligrams per thousand cubic feet of air. The maximum weight was 204 milligrams.

Twenty-three comparative tests were made to determine, with particular care, the weight of dust in the air of the subway and in that of the streets at the same times and as near the same places as possible. These showed an excess in the subway over the outside air averaging 47 per cent. In eighteen cases, the weight of dust in the subway air over that in the air of the streets ranged from 11 to 800 per cent.

The origin of a large part of the subway dust seems fairly evident. Much of the organic matter and silica are probably carried in from the streets by the currents of air and the movements of passengers. Some is produced in the subway by the gradual wear and tear of wood and cement and other materials of construction, and imperceptible losses from such easily destructible matters as the clothing of the passengers. But all of the dust is not produced in this way. A considerable amount is pulverized metal ground up by the operation of the trains.

It has been demonstrated that the metal in the air is chiefly cast iron derived from the grinding of the powerful brakes of the cars. It is a matter of official information that the loss in weight of the brake shoes, which are the principal wearing surfaces, has amounted to one ton per mile per month. In addition, the wheels themselves and the tracks are being constantly ground up, especially at the curves.

It must not be supposed that the great aggregate weight of metal which these figures indicate is wholly converted into dust and mingled with the subway air which is breathed by the average traveler. Many of the iron particles are too large and too heavy to be carried far, even by the strongest draughts of the moving trains. Many bits of smaller size, after being whirled about for a brief period, settle upon the oily tracks or fall into the voids in the broken stone ballast and are so retained. Only a portion of the finer particles find their way into the general atmosphere of the subway and are kept afloat there by draughts.

At the same time, it is needless to point out to a body of physicians the significance which attaches to the presence of a large amount of finely divided metallic iron in the air. I have advised the Board that the possibility that the metal particles in the air of the subway may produce injurious effects upon health should be thoroughly investigated.

ODOR

There yet remains a single subject of general interest to refer to: The odors of the subway. No condition, excepting the heat, has caused as much personal discomfort as the odors. Yet a brief reference to them will suffice. Odors have been more or less present at all times and at all places in the subway. In some cases they have been so faint as hardly to be noticeable, while in others it has been possible to detect them on the streets over a hundred feet from the nearest opening. The odors have been most apparent during hot, damp weather, where the greatest crowding has occurred and in those parts of the subway which are most enclosed.

The cause of the most prominent odor has been the lubricating oil used on the trains. An exceedingly large quantity of this oil was used on the machinery during the first year of operation and was allowed to drip upon the ballast and ties of the roadbed.

The next principal cause of odor has been the broken stone ballast of the roadbed. This stone is trap rock, which, like slate, gives off a characteristic odor when wet. On rainy days, and at those parts of the subway where the moist atmosphere has the freest access to the ballast, the peculiar slaty odor of the stone is most pronounced.

A pungent and peculiarly unpleasant odor has been given off by a proprietary disinfectant used in the toilet rooms. Laboratory tests have shown that this compound has practically no germicidal or deodorizing properties. Its only claim for use seems to lie in its capacity to overpower other, and possibly less unpleasant, odors. In my judgment, disinfectants and deodorants possessing an odor should rarely, if ever, be used in the subway.

Excepting where the crowding has been excessive and, in rare instances, where certain employees have not been under as strict supervision as their defective sense of decency has rquired, the odors of the subway have not pointed to conditions dangerous to health.

SUMMARY

If I were to summarize the findings and conclusions of my investigation into the narrowest possible form, I should say that I think the subway, as a whole, is sufficiently ventilated and free from conditions injurious to health, except as to the presence of metallic dust, lack of sanitary care, and conditions inseparable from overcrowding. The lack of sanitary care can, and probably will, be corrected. I do not know whether it will be necessary to do anything about the dust. If it is really dangerous, American ingenuity can certainly find a way to reduce it.

THE ANTI-SPITTING ORDINANCE IN GRAND RAPIDS

In accordance with the anti-spitting ordinance recently passed by the Common Council of Grand Rapids, Mich., the Grand Rapids Railway has issued the following bulletin to its carmen: "The Common Council of the City of Grand Rapids has passed an ordinance making it a misdemeanor to spit in street cars, and providing a penalty of a fine of from $1 to $50 upon conviction. This ordinance practically obligates our company to use any necessary means to stop the disgusting habit. You are instructed to keep a watch out for passengers who forget themselves, taking the names of the guilty parties, calling their attention to the reason for so doing, and also taking the names of witnesses, if possible to obtain any, in order that arrest and conviction may be secured. Make a written report of the matter, given the names of the witnesses. You are not expected to make an ejectment because of this offense, except in very aggravated cases, it being preferable to make the offender answer to the law."

FIGHTING SNOW ON AN IOWA INTERURBAN

The interurban electric railway, with its less traffic and greater exposure to the weather, finds the snow problem much harder than the city lines which can afford more snow-fighting apparatus per mile of track. A pictorial proof of this fact

FIG. 1.—SIDE VIEW OF LOCOMOTIVE STRIKING DRIFT

is afforded by the three accompanying illustrations taken recently along the line of the Waterloo, Cedar Falls & Northern Railway Company in Iowa, operating about 80 miles of track,

FIG. 2.—ENGINE STRIKING DRIFT HEAD ON

of which 30 miles is electric and the balance steam. Snow is a frequent visitor to this district during the winter months, and the winds blowing over the prairies seem to take a special

FIG. 3.—LOCOMOTIVE STUCK IN THE SNOW

pleasure in drifting it along the tracks of this company.

These interesting views were furnished by C. D. Cass, general manager of the company, who believed they would prove of special interest to those in milder climes than Iowa.

MEETING OF THE CENTRAL ELECTRIC RAILWAY ASSOCIATION

More than 150 members attended the first business meeting of the Central Electric Railway Association, held at the Claypool Hotel, Indianapolis, March 22. The intense interest and enthusiasm of the members of this new and promising organization, which was recently formed by the consolidation of the Ohio and Indiana State associations, are best shown by the fact that although a large number of the roads in this district had been tied up by snow storms, the representation from all parts of both States was not only very creditable but there were members present from Pennsylvania, West Virginia and Illinois.

General Manager C. D. Emmons of the Fort Wayne & Wabash Valley Railway brought a large party from points in northern Indiana and western Ohio, starting from Lima over the Fort Wayne, Van Wert & Lima to Fort Wayne, then over the Fort Wayne & Wabash Valley to Peru and over the Indiana Union Traction Company's line to Indianapolis, a trip of over 200 miles. They traveled in a magnificent new 62 ft. parlor buffet car, one of four soon to be placed in regular limited service between Fort Wayne and Indianapolis. Special trips from Cleveland and Columbus to Indianapolis had been planned for, but they were abandoned on account of snow storms in Ohio.

President Edward C. Spring opened the meeting by congratulating the members upon the large attendance in the face of most adverse conditions. He announced that the permanent secretary, J. H. Merrill, had opened a neat suite of offices in the Traction Terminal Building and urged the supply men, as well as the operating men, to visit the headquarters whenever they were in town. He said it would be one of the chief duties of the secretary to furnish pointers and information to the supply men, and he wanted them to feel free to call upon him at any time for anything that could be supplied through such an office. He said that, like a "new broom," the secretary had started out with tremendous energy and already had done much good work in the way of compiling data and promulgating information of value to the various roads. For instance, he has under way a compilation showing the wages and hours of nearly all the employees, classified under heads, of nearly all the interurban roads in the Central West. This is most valuable information for comparisons. Another interesting compilation will show the clearances and dimensions of the cars of various roads and the maximum dimensions permissable on the various roads. This is also of tremendous value, enabling one operator to send his cars over another line without fear of the possibility that they may not be able to run over the foreign road. A "Trolley Guide," to contain maps, time tables and other valuable information for travelers, is being prepared for, and it is believed that eventually this will be made a source of revenue for the association. President Spring expressed the opinion that the "new broom" was of such excellent quality that it would not only continue to "sweep clean" indefinitely, but would improve with age.

Nearly all the roads represented in the new association have agreed to contribute the $50 asked for for the support of the secretary's office for the first year, and the few that have not were urged to give the matter prompt attention. Mr. Spring said he could confidently assure every road that the results obtained from this plan of co-operation would be worth many times that amount. In the near future the secretary's office will become the clearing house for the interchangeable coupons collected by the various roads in the interchangeable transportation agreement. This work is now handled by the individual roads, and the change will be of great assistance to the various roads.

The following committees were announced for the ensuing year: Subject and Arrangement Committee, President E. C. Spring, Secretary J. H. Merrill, Treasurer W. E. Millholland; publicity committee, George S. Davis, Cleveland; J. R. Harrington, Canton; E. B. Grimes, Dayton; transportation committee, F. W. Coen, Cleveland; T. D. Norvall, Indianapolis; F. W. Adams, Fostoria, O.; D. G. Edwards, Cincinnati; insurance committee, Henry J. Davies, Cleveland; C. L. Henry, Indianapolis; Theodore Stebbins, Columbus. Local committees of three members each will be appointed in each large city in the district. It will be their duty to secure new members, look after the interests of the association in their district and to bring matters of interest and importance to the attention of the secretary.

The next meeting will be held at the Chittenden Hotel, Columbus, May 24. E. L. Hamilton, of Chicago, who was to have spoken on "Railway Y. M. C. A. Work," and Henry Staats, of Cleveland, who was to have spoken on "Insurance at Cost," were unavoidably absent and they will speak at the next meeting. At this meeting also a number of matters of general operating practice which have recently been brought up will be discussed.

PARLOR LIMITED CAR OF FORT WAYNE & WABASH VALLEY RAILWAY, WHICH TOOK PARTY FROM LIMA AND POINTS IN NORTHEASTERN INDIANA TO THE MEETING

Newspaper reports in forecasting the Indianapolis meeting, stated that the Ohio electric roads were losing business as the result of the recent enactment of a 2 cents per mile law on the steam roads, and that at this meeting the advisability of reducing rates to 1½ cents per mile would be considered by the traction lines. This report had no foundation of truth. The question has not been considered either by the officers of the association or by any of the individual members. An informal investigation by the STREET RAILWAY JOURNAL among the Ohio members at this meeting indicates that the traction lines will not suffer by this reduction in steam road fares. On some of the long hauls and interline business, it is possible that the reduction may have a slight depressing effect, but as has been frequently pointed out, the average on Ohio electrics is still considerably below 2 cents a mile. On the short hauls the electrics are undoubtedly the gainers by the change, because the steam roads have cut off their low round trip rates, "twin tickets," etc., and charge the full 2-cent rates where they formerly did much business for less.

The morning session was addressed by E. J. Burke, president of the Blake Signal & Manufacturing Company, on the subject, "Electric Railway Signals." The subject was particularly interesting at this time because the Indiana Union Traction Company, the most important system in the State, has just adopted the Blake signals on its main line. Several of the signals with their controlling apparatus were installed in a room adjoining the hotel entrance, and they were thoroughly inspected by the members after the reading of the paper.

BLOCK SIGNALS

In prefacing his description of the outfit, Mr. Burke said that the Blake signals are practically visual telephone signals, and their use removed the one-sided feature of the present telephone system; that is, it made it possible for the despatcher to communicate with the motorman at will. The invasion of electric roads into steam fields makes it necessary for the electrics to follow closely the systems of operation and despatching of the steam roads. The steam roads have more or less frequent stations with telegraph operators, and while the electrics to a great extent have station agents, yet by reason of the more frequent headway and numerous passing points, it is frequently desirable and necessary to communicate with the train crew between stations, and change their orders to meet new conditions. On special days and holidays this necessity is especially marked and the dangers through inability to communicate with crews is increased in greater proportion. There is also especial need for such communication at times when lines are blocked by snow and snow plows. Nearly all electric lines have installed telephones at passing points, allowing the crew to communicate with the despatcher, but has left unsolved the more important matter of permitting the despatcher to selectively communicate with the crew. It is, of course, possible for crews to call at every siding, but the loss of time and the annoyance to passengers makes such practice undesirable, besides which, the despatcher would be kept busy answering such calls, and is more liable to make a disastrous mistake. The loss of time means also an increased number of crews and cars to operate a certain schedule, additional power consumption, feed wire, maintenance expense and supplies.

Even where crews call only at certain stations, the crews become accustomed to stopping at these points and are apt to forget to stop at other sidings where they may have been ordered to do so.

Therefore, the thing needed in connection with every telephone on the line is a simple, positive signal rendering it possible for the operator to attract the attention of the motorman at any telephone station. The Blake signal was designed to meet these requirements, and Mr. Burke stated that it had proven successful in various parts of the country during winters of exceptional severity as well as through summers of heavy traffic and the usual electrical disturbances.

He pointed out that the Blake signal is not intended to cover the field of automatic block signals, as it is not operated by the crews of the cars, but by the despatcher himself. It gives the despatcher the same command over the crews that the steam despatcher enjoys by using a telegraph system with frequent stations, but the operation is simplified in that instead of communicating with the telegraph operator and instructing him to transmit the order, the despatcher communicates directly with the crew. The system is entirely independent of the telephone, and where telephones are already installed the signal may be put up as an adjunct.

The apparatus consists of a despatcher's office equipment and line semaphores, each signal containing an electro-magnet and pendulum. The signal pendulums vary in length, and each corresponds in length to one of the pendulums in the despatcher's office. The office equipment consists of a desk-like box containing pendulums of different lengths and platinum points which are made and broken by the swing of the pendulums, at intervals varying with the length of the pendulums. Therefore, if one of the pendulums in the despatcher's office is released, electrical impulses are set up and energize magnets on all the signals on the system. However, only the one pendulum, whose length is the same as that released in the despatcher's office, will be released by these magnetic impulses. On the other signals, the impulses being out of beat, the pendulums will receive a check before they have swung through any considerable arc. On being tripped the pendulum, having reached a certain arc of vibration, mechanically trips a 3-ft. semaphore arm which falls to a horizontal position. This semaphore closes a local signal lamp circuit and also closes a shunt to ground on the signal line causing a sounder to draw up in the despatcher's office, notifying him that the signal has operated. After the train crew has communicated with the operator by telephone, the conductor or motorman pulls a cord which sets the semaphore at "clear" position ready for future operation.

In his demonstrations Mr. Burke pointed out especially that when properly set and adjusted it is physically impossible for any other signal than the one desired to operate. Since there is a positive indication to the operator that the semaphore has been set in the horizontal position and until the arm has reached an angle of about 45 degs, it is impossible for the despatcher to get this indication, the danger of a false indication is eliminated. Moreover, the power for operating the signal is obtained entirely through the despatcher's office, and there is no local circuit at each signal other than the signal lamp circuit. There are also no electrical contacts in series with the operating magnets at the various signals. The signal line is electrically continuous throughout from the despatcher's office to the return circuit at the end of the line. If one signal lamp becomes burned out, a second lamp is automatically cut into circuit and gives a flashing light so that any train crew can report it and a new lamp is put in the following day. This plan eliminates the necessity for daily inspection of lamps. The varying voltage of trolley lines is taken care of by relays which draw up at different voltages and cut in or out resistance as the voltage rises and falls. By this means a variation from 300 volts to 700 volts is taken care of. The line consists of a single No. 10 bare iron wire supported on glass insulators.

In the discussion which followed, Mr. Burke was asked how the systems were protected against lightning. He replied that on a 40-mile line in Illinois, in operation for ten months, they had not thus far lost a signal from lightning. There is a lightning arrester on each signal outfit, consisting of carbon spools with an air gap between and designed for a breakdown test of 10,000 volts. In some cases the lamp circuits had been interrupted by lightning, but not the signals themselves. This did not destroy the efficiency of the protection because the signals when thrown are easily seen where arc headlights are used. In fact, some roads are willing to dispense with the signal lights entirely.

J. C. Rothery, of the East Liverpool Traction & Light Company, asked if the signal went to "danger" in case it was injured in any way, as by a falling tree or branch.

Mr. Burke replied that it did not, as it was not an automatic signal. He said that in case of such accident the operator would know that the signal was not in operative condition, as he would not receive a return signal. If it was an urgent case the operator could shut down the station, but in any event he was no worse off than at present without the system.

C. L. Henry, of Indianapolis, asked if the system would operate if the voltage dropped below 300. Mr. Burke said it would not. He though the voltage seldom dropped below this point on the best interurban roads.

In answer to an inquiry as to the length of time required to set a signal at "danger," Mr. Burke said it took 15 seconds.

Uniformity of period was secured by equalizing the pendulums, placing a greater mass on the shorter levers and a smaller mass on the longer levers.

AIR BRAKES

The afternoon session was devoted to the reading and discussion of a paper on the subject "Advancements and Improvements in Air Brakes," by W. V. Turner, mechanical engineer of the Westinghouse Traction Brake Company, with an introduction by S. D. Hutchins, special representative of the same company. In part Mr. Hutchins said:

"It may seem like a broad assertion, but the developments and advancements of heavier equipment, higher speed and quick service, on both steam or electrically-operated railways are restricted to the capacity of power brakes to overcome the inertia and destroy the energy of a moving train. Every advancement or development in the motive power and other conditions that make higher speeds possible is in a measure a menace to the traveling public unless the factor of safety is increased proportionately. One of the most important problems to be considered in this connection is the distance in which it takes the car or train to stop in an emergency This point has been considered paramount in the development of air brakes for steam service, all other conditions of flexibility in operation being considered points of refinement. It is now possible to stop a modern high speed passenger train weighing about 700,000 lbs. from a speed of 60 m. p. h. in less than 1000 ft. Such brakes are in use on nearly every steam road in North America. They are simple and reliable and are interchangeable in parts. Every detail conforms fully to the high standards of the Master Car Builders' Association.

About five years ago we were called upon by an interurban construction company in Michigan to furnish automatic air brakes for electrically-driven cars. On this order ten cars were equipped with our standard steam railroad quick-action brake with a rotary motor-driven compressor. It was soon found that we had made a mistake, and the frequent complaints of undesired quick action, rough handling of the car, slow release and reduced efficiency of brake power in emergency immediately following release, resulted in removing the quick-action automatic and substituting the straight-air type. Every objective point was noted in detail before the automatics were removed and experiments were carefully conducted to overcome the objections. In a large measure these were overcome by a combined automatic and straight air equipment, in which the straight air could be used on the car while being operated as a single unit and the automatic feature was used while the car was being operated in multiple unit.

"In the meantime we continued to furnish straight air brakes until about a year later, when our traction brake department was formed to engage actively in furnishing air brakes for electrically-operated railway cars. As we had anticipated, it soon became apparent that the straight air schedule would not serve for the proper handling of cars in trains and several serious accidents occurred by cars parting in transit. The official action of the Master Car Builders' Association in condemning the use of straight air brakes for train service, and the growing tendency of electric roads to use them, further agitated the question of automatic brakes for such service. Our efforts were conducted in the direction of working out a suitable automatic schedule fully covering the requirements of interurban train service."

Mr. Turner's paper was profusely illustrated with stereopticon views and by a working model of one of the latest Westinghouse braking systems as applied to a five-car train.

He opened with a description of some of the earliest forms of brakes and followed the development step by step up to the electro-pneumatic brake, which he said was the highest development in the art. He said that the development of air brakes since they were first brought out had kept pace with improvements in locomotion, and that the present appliances for a speed of 80 m. p. h. were more efficient and would stop a train in a shorter distance than those used when trains were only one-quarter the present weight and when the maximum speed was about 30 m. p. h.

The illustrations of some of the earliest forms of brakes were most interesting. One consisted of a wooden block placed between the wheels and was applied by the brakeman standing on the block. Another was operated by a hand lever. The storage air system, which was illustrated with several views, was characterized as being a very efficient and economical system for single cars, but undesirable on account of its limitations in that cars could only be charged at certain places and could not travel over roads not equipped for this system.

The frequent stops, rapid acceleration and unusually severe service of high-speed electric roads, and especially the demand for trains operated as a single unit made it necessary to design something most reliable, at the same time one which would gain every second in braking. It was desirable to have graduated application as well as graduated release and also to have the quick service feature. It was also desirable to have quick recharge without decreasing the braking efficiency, that is, a brake in which it was impossible to use the air too fast. Much time and experimental work was spent in producing such a brake, and a great many improvements have been brought out within the past two or three years.

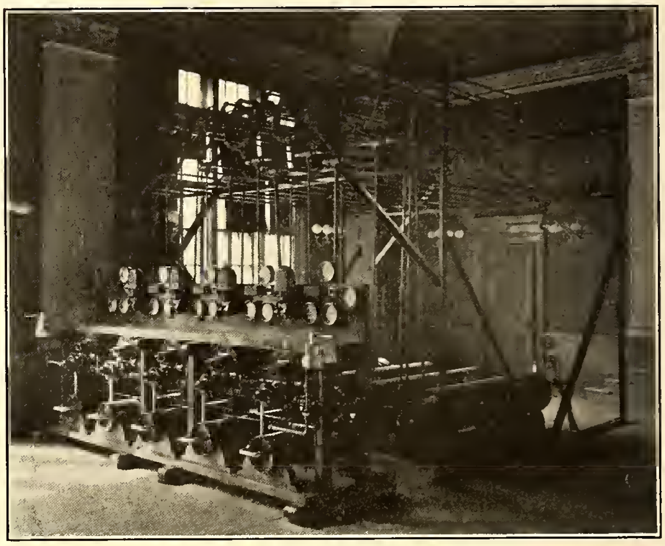


EXHIBIT OF WESTINGHOUSE AIR BRAKES AT MEETING OF CENTRAL ELECTRIC RAILWAY ASSOCIATION

One of the first was a combined automatic and straight air brake. This was an attempt to get the flexibility of the automatic and the graduated application features of the straight air. This brake could be used gradually on and off to get smooth stops, or could be applied quickly, but it was applicable only for one car. The S. M. E. type, another cross between the straight air and the automatic, was used on the Pittsburg Railways. It was flexible and safe for two cars, but it was suitable only for two cars, as the air had to travel too far. It also had the objection of requiring two sets of hose. It was very satisfactory where it was desirable at times to use trail cars, as it operated equally as well on one or two cars.

The A. M. S. type, another new device, was used in Boston. It was for two-motor cars when operated together or for motor or trailer and was purely an automatic brake, except so far as the release of the first car was concerned. With this outfit it was possible to release the trailer and hold the motor, then gradually release the motor.

One of the latest developments was the A. M. T. type used on the Boston tunnel cars. This was designed for heavy traction service for handling any number of cars up to five with one brake control. It had all the features of the combined straight air and automatic. There was but one brake valve and there was no danger of braking power becoming depleted for lack of ability to recharge, as this was accomplished in less than 7 seconds. There were practically no additional parts as compared with the automatic, yet it gave the desired features of quick service, quick discharge and graduated release, this being accomplished by one other pipe connection and two other ports in the triple valve.

The A. M. R. type, now used on the Manhattan Elevated, showed the same advantages with the additional feature that it could be used for more than five cars. It had the desired quick action feature not only when the motorman threw his lever to emergency position but when the hose parted at any part of the train. These features are accomplished by adding one simple improvement to the triple valve. The A. M. R. system is used on the Long Island Railway with as many as eight cars.

The latest development was the electro-pneumatic brake which is practically the same as the A. M. R. type, with the addition of electric-control feature. The added parts consist of contacts added at the brake valve and a set of magnets controlling the operation of the triple valve. With this system it is possible to apply and release the brakes with absolutely no loss of time and with no departure from the usual method of application. The advantages are its simplicity of operation, making it possible to thoroughly instruct a green motorman concerning its operation in a very short time, and its instantaneous action in emergency. The Boston Elevated is now using this system, and a train equipped with it was illustrated. Mr. Turner expressed the belief that this system showed all the necessary requisits of the perfect brake, viz.: Simplicity, flexibility, interchangeability and the added advantage of being fool proof.

Flexibility of operation, Mr. Turner said, was more desirable on electric trains than on steam on account of their higher acceleration and hence possible speed. With this increased speed there is an increased demand for a higher factor of safety. Greater accuracy is required in the stopping of electric cars. The elevateds stop at markers, while the high-speed interurbans stop at street crossings or station platforms, while steam trains can stop almost any place within reasonable limits. To secure a smooth, accurate stop in the minimum time, it is necessary to have a means of applying the brakes severely and then graduating out to a stop; at the same time it is necessary to have quick return to full power after each movement of the lever. In a word, the ideal automatic brake will give quick service, graduated releases and quick return, with the flexibility of the straight-air brake and without its detrimental features.

Mr. Turner stated that on the Interborough the average time for stops with the old equipment was 21½ seconds and with the new 12½ seconds. This saving in time meant that ten trains could cover as much ground and carry as many passengers as eleven trains with the old system. The safety feature was shown with four applications in service and one emergency with both systems. The new equipment showed 50-lbs. pressure after each application, while the old graduated down; 50 lbs., 45 lbs., 40 lbs. and 35 lbs. To charge the brake reservoir full required 30 seconds on the old and 5 seconds on the new equipment.

Showing the difference in service conditions between steam and electric, Mr. Turner said that the Twentieth Century Limited, running from Chicago to New York in eighteen hours, required not over 100 movements of the triple valve. An ordinary freight train required not over 200 and an ordinary passenger train not over 500 in twenty-four hours, while those on elevateds average 3744 movements of this valve daily.

The exhibit mounted in the hall consisted of an A. M. T. outfit for heavy interurban service with equipments for five cars, consisting of compressors, governors, main reservoirs, reducing valves, triple valves, auxiliary reservoirs, brake cylinders and gages, together with the necessary piping and connections. The various experiments showed efficiency as indicated by gages with quick application, serial service applications, graduated release and by the breaking of pipes. They showed that the operation was positive and almost instantaneous under the various conditions and that the return to full working pressure was instantanious after each application. The exhibit was said to be the most complete ever shown outside of a National Convention, and it was the general sentiment among association members that the paper was one of the most instructive they had ever listened to.

There were several small exhibits in the hall.

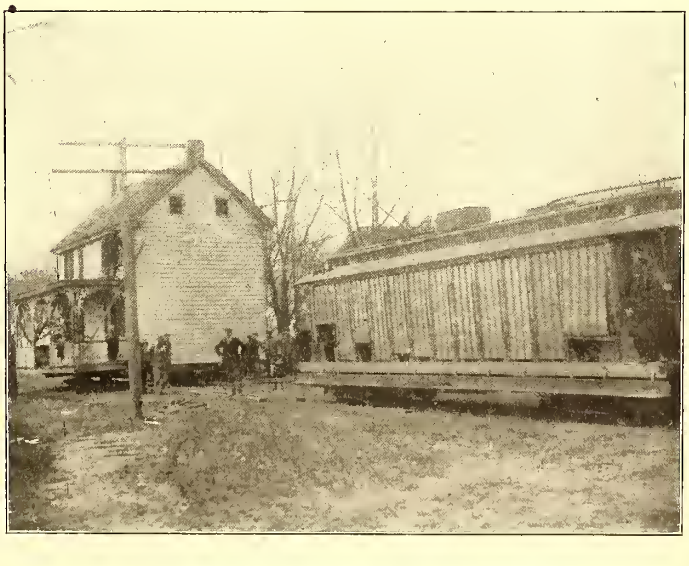
E. C. Rutherford, of the National Brake Company, Inc., of Buffalo, showed a model of the Peacock brake.

W. E. Ludlow, of the Cleveland Armature Works showed the Cleveland track drill.

Mr. K. D. Kequemborg, of the Franklin Car Heating Company, showed a model of a new coke-burning hot-water heater.

TROLLEY CAR MOVES A HOUSE SUCCESSFULLY AT ATLANTIC CITY, N. J.

A car of the Atlantic City & Suburban Traction Company, of Atlantic City, N. J., was substituted for a horse as motive power in moving a dwelling recently. The span wires were taken down one at a time, and the trolley wire pulled to one side, sliding along the side of the house, two linemen taking down and putting up the wires as fast as the house was moved. The illustration herewith shows the house being moved.



TROLLEY CAR MOVING A HOUSE

ANNUAL MEETING AND DINNER OF THE NEW ENGLAND STREET RAILWAY CLUB

The regular business meeting and sixth annual banquet of the New England Street Railway Club were held at Hotel Somerset, Boston, on March 22.

The business session was held at the hotel in the afternoon. After the routine work had been completed, B. V. Swenson, secretary-treasurer of the American Street & Interurban Railway Association, was invited to give an informal talk on the plans and purposes of the national associations.

MR. SWENSON'S REMARKS

Secretary Swenson first sketched briefly the history and objects of the main and affiliated associations and gave statistics of their membership. All of the affiliated associations have adopted new constitutions as the result of the reorganization. Those of the Accountants' Association and the Claim Agents' Association provide for active members only, and these members are composed of the company members of the American Street & Interurban Railway Association. The work of these associations is of such character that it has been considered unadvisable to them that membership should extend beyond the member companies. As the Railway Engineering Association formerly had both the company members and individual members, and as furthermore its work is of such a nature that individual membership is desirable, this association has two classes of members: Active membership, which consists of the various member companies of the American Street & Interurban Railway Association, and individual membership, which consists of associate members of the American Street & Interurban Railway Association who have allied themselves with the Railway Engineering Association. These associate members obtain all the privileges and receive the proceedings of both the Railway Engineering and American Street & Interurban Railway Association.

Another important result of the scheme of reorganization has been the entire revision of the annual dues paid by member companies. Membership in all four organizations previous to the reorganization cost each company $70 per year; $25 to the American Street Railway Association, $20 to the Accountants' Association, $20 to the Mechanical & Electrical Association, and $5 to the Claim Agents' Association. It was considered unjust that a company with annual gross receipts under $50,000 should pay to the Association the same amount that was paid by a company whose annual gross receipts were 200 times as great. Seventy dollars was too much per year to expect a small company to pay, whereas the larger companies could well afford to pay much more than that in return for the benefits received. It was therefore decided that the most equitable basis for fixing the annual dues would be one which is based upon the annual gross receipts of the companies. This schedule starts at $15 per year for companies having annual gross receipts under $50,000, and ends at $600 for companies whose annual gross receipts are $10,000,000 and over. Upon the present basis of company membership the annual dues will bring to the Association approximately $20,000 a year, which amount is none too great to carry on the important work of the four associations.

In regard to associate membership Mr. Swenson said that individuals may become associate members of the American Street & Interurban Railway Association upon the payment of $5 annual dues. This membership carries with it associate membership in the Railway Engineering Association, if the member so desires, besides the general privileges of the convention.

Mr. Swenson then outlined briefly the work now being undertaken by the four associations, and by the committees on mail, insurance, promotion of traffic, heavy electric railways, welfare work, municipal ownership, public relations and standardization of equipment.

The work which was laid down at the Philadelphia convention has been steadily going forward, and the success of the new Association is assured. Fifty-seven new member companies have joined as a direct result of the reorganization, and applications for membership are being received from time to time. The old member companies have in general signified their hearty approval of the new conditions of affairs, and have come forward to the support of the work. We have received but very few letters from member companies stating that they do not wish to continue in the Association work. However, it is quite essential that all the companies which were members of the American Street Railway Association should stand together in the support of the reorganized Association. The work demands not only a continued membership of these companies, but also a considerable increase due to the joining of additional new members. There is no reason why the Association should not have 600 or 800 member companies, and there is no doubt that the work will soon become so apparent to the managers of electric railway companies that the membership will increase to this number.

Mr. Swenson also announced that the annual convention would probably be held in Columbus, Ohio, and described some of the advantages of that city for a convention of the Association.

NEWLY ELECTED OFFICERS

The annual election of officers was also held at the afternoon session, in order that the entire evening might be devoted to the banquet. As a result of the balloting the following officers were declared elected for the ensuing year:

President, Paul Winsor, of Boston.

Vice-presidents: For Massachusetts, H. E. Reynolds, Boston; for Connecticut, L. Bentley, New London; for New Hampshire, E. T. Miller, Concord; for Vermont, W. E. Robertson, St. Albans; for Rhode Island, Myron A. Webber, Westerly; for Maine, F. C. Farr, Brunswick.

Secretary, John J. Lane, Boston.

Treasurer, N. L. Wood, Boston.

Executive Committee: E. E. Potter, New Bedford, Mass.; E. P. Shaw, Jr., South Framingham, Mass.; M. C. Brush, Newtonville, Mass.; W. H. Blood, Jr., Boston; F. M. Nellis, Boston; E. L. Janes, Boston; Charles B. Price, Boston.

Finance Committee: Paul Winsor, Boston; John W. Corning, Boston; P. W. Davis, Boston.

THE BANQUET

The banquet was held in the grand ball room of the Hotel Somerset and was attended by about 350 members and guests. Paul Winsor, the president-elect, introduced as the toastmaster of the dinner, Russell A. Sears. The speakers of the evening included W. Caryl Ely; Samuel L. Powers, of Boston; Fuller C. Smith, chairman Board of Railroad Commissioners of Vermont; and Charles F. Libby, president of the Portland Railroad Company, of Portland, Me. Owing to snow bound trains, George Tate Blackstock, K. C., of Toronto, Canada, who was to have been one of the speakers, was unable to reach Boston in time, and was forced to telegraph his regrets.

Mr. Winsor announced that the membership of the club was now over 600, and there was more than $2500 reserve in the treasury.

Mr. Ely said he had been for many years a strict advocate of government supervision of railways by such boards of commissioners as existed in the New England States, as such supervision strengthened the securities of the roads. Had there been such board early established in other States with proper powers, there would not have been seen the great agitation for municipal ownership of street railways that has prevailed in the last few years.

Wherever the government exercises supervisory control there the property is most secure and usually there is no agitation for three-cent fares. In Ohio there is more agitation for cheap fares than in any other State in the Union. In the States where people had proper knowledge of the business of the corporations and where there was publicity of these affairs, there had in several instances been an increase of fares with the assent of the government authorities.

Mr. Ely said the question of municipal ownership had been taken up by the National Civic Federation, which was making a study of the places where it had been tried, both in this country and abroad. He felt that the results achieved abroad had been misrepresented, and that if a fair comparison were made between cities abroad of equal population and similar conditions that had tried municipal ownership with similar cities in this country where the utilities were in the hands of private corporations, the results would be found in favor of private ownership.

He cited a ferry in New York which had passed from private to public ownership and which had lost over $300,000 in a year, the excuse of the commission in charge being that ferries, like public highways, ought to be free.

If the deficit continues, said Mr. Ely, the excuse will also continue. If this is true of ferries, why not of street railways, lighting and other utilities. That would be lovely for those who are not taxpayers, but how about those who pay taxes.

The municipal ownership idea means not merely ownership, but operation. How can any one contend that the street railways in cities like New York and Boston would be operated with as much general satisfaction under present political conditions as by the private corporations? It is absurd.

The facts are unmistakable. We know that the conduct of present municipally-owned utilities if applied to street transportation must result in complete failure unless the street railways shall be supported by taxation and transportation is free.

We must trust to the fairness and common sense of the people of this country in this matter. We are not socialists. A great many of our people are property owners who have some regard for property rights and the rights of other people. We are all by nature respecters of our neighbor's rights, and nowhere are vested property rights held more sacred than in this country, where all men are molders of their own fortunes.

Mr. Ely said that the development of street railways was one of the most marked features of recent American life, and it had served to check the tendency toward congested population in cities by offering facilities to get away into the country.

He next touched on the electrification of steam roads, and cited the work in this direction which is contemplated by the New York, New Haven & Hartford Railroad. He believes it is inevitable and will solve the transportation problem of the future. A comprehensive scheme of transportation under such conditions he thought would be: First, a heavy railway, the great trunk lines, for long hauls of passengers and freight; second, light railway connections for towns and villages lying along these trunk lines, and third, the street railways in cities and towns performing the functions of local transportation and connecting at the railroad stations with the other lines. He believed the interurban road performs a service that it is impossible for the steam roads to perform.

Following Mr. Ely were the other speakers of the evening, all of whom made interesting addresses. The banquet was over shortly after midnight.

COLUMBUS, OHIO, THE NEXT CONVENTION CITY

The announcement has just been made that Columbus, Ohio, has been selected as the next convention city. This statement is contained in a notice which Secretary Swenson mailed last week to all members of the American Street & Interurban Association and its affiliated associations. The notice follows:

PRELIMINARY ANNOUNCEMENT

The annual convention of your associations will be held in the city of Columbus, Ohio, the week of Oct. 15-20, 1906. The days upon which the different associations will hold their meetings have not yet been definitely decided upon, but this matter will be given attention at an early date.

The executive committee of the American Street & Interurban Railway Association considers that it is highly desirable to hold the next convention in one of the interurban railway centers of the Middle West. Special committees of the "American" Association and of the "Manufacturers'" Association were appointed to consider this matter and to decide upon the location of the 1906 convention. After a careful investigation, which included visits to various cities, Columbus was the unanimous choice of the committees. It affords most excellent facilities and is admirably located for the purposes of the association.

HOTELS

Columbus is the State Capital and has successfully taken care of many large conventions. It possesses four large, well-appointed hotels, as well as several first-class smaller ones, which collectively can guarantee about eleven hundred rooms, many of these with bath, if desired. The rates for one person, on the American plan, vary from $2 upward, and on the European plan, from $1 upward. Those who desire to do so can make reservations now by addressing B. N. Harmon, secretary convention committee, Columbus Board of Trade, Columbus, Ohio.

EXHIBIT OF THE MANUFACTURERS' ASSOCIATION

Most excellent facilities have been provided for the manufacturers' exhibition, which has become such a feature of the National Street Railway conventions. The exhibit halls are located on the State Fair Grounds, which are within 15 minutes' ride of the principal hotels. There are six adjoining brick exhibit halls; four buildings 110 ft. x 200 ft., and the other two 100 ft. x 150 ft. In addition, there are three covered sheds with brick pavements, 100 ft. wide by 400 ft. long. The Manufacturers' Association will have a larger and more comprehensive exhibit than ever in the past. The Big Four Railroad tracks will be run directly up to the buildings.

THE CONVENTION HALL

The assembly or convention hall is 80 ft. x 100 ft., comfortably seating from 600 to 800 people, and is in close proximity to the exhibition halls. If desired, one of the six buildings can be used for the convention hall, with a seating capacity of 1500 people. All of the buildings can be heated by natural gas and will be lighted by electricity. Sufficient power to operate exhibits will also be available, both 500-volt direct current and 110-220-volt, 60-cycle alternating current.

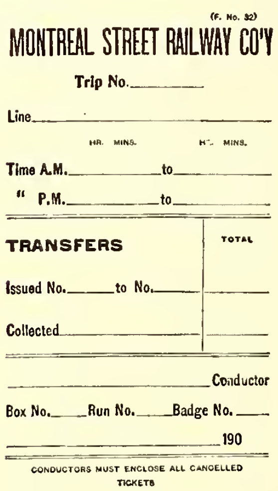
CONVENTION COMMITTEE

President Ely has appointed a convention committee which will have these general matters in charge, and a second announcement containing more specific details of the convention will be issued within a short time.

The Chicago & Southern Traction Company has issued a handsome folder. On the inside is shown a map of the system, with all the towns reached between Indianapolis and Chicago. The system is divided into three divisions, the main line from Chicago to this city, the Hammond and Joliet divisions. Cars are to be run every fifteen minutes between Chicago and Chicago Heights and every thirty minutes between Chicago and Kankakee. The company will serve a territory that is constantly growing, including the cities of Joliet, Kankakee, Hammond, Harvey, and Chicago Heights, the combined population of which is upwards of 300,000. Outside of these it is expected that half a million people will be served in other cities and towns along the line.

HANDLING TRANSFERS ON THE MONTREAL STREET RAILWAY COMPANY

In connection with the Montreal Street Railway Company fare-box collection method it may be of interest to mention how this company issues, collects and disposes of transfers. Two of the illustrations present a copy of the standard transfer, and the transfer issue form on which are recorded the numbers of the pads of transfers issued to each conductor and returned. Two sets of transfers are used each day, blue for a. m. and white for p. m. They are put in



(F. No. 32)
MONTREAL STREET RAILWAY CO'Y
Trip No.
Line
HR. MINS. HR. MINS.
Time A.M. to
" P.M. to
TRANSFERS TOTAL
Issued No. to No.
Collected
Conductor
Box No. Run No. Badge No.
190
CONDUCTORS MUST ENCLOSE ALL CANCELLED TICKETS

FACE OF ENVELOPE CONTAINING TRANSFERS

Wind. & St. Lawrence
AMHERST
BEAV. HL. & DEL.
PK. LAF. & PK. AV
CENTRE
GUY ST. CATH
NOTRE DAME
ONT. WEL'TON
ST. DENIS
ST. ETIENNE
WIN. & ST. LAW.
N L E W
MAR-1906
13 5224

1	10	20	30	40	50
2	10	20	30	40	50
3	10	20	30	40	50
4	10	20	30	40	50
5	10	20	30		50
6	10	20	30	40	50
7	10	20	30	40	50
8	10	20	30	40	50
9	10	20	30	40	50
10	10	20	30	40	50
11	10	20	30	40	50
12	10	20	30	40	50

TRANSFER TICKET

pads of 50 each, and issued to the conductors in lots of from 50 to 200 when taking out their cars, according to the demand on the different lines. When issuing transfers, conductors are required to correctly punch the "direction from," "direction to," "line," and time. To facilitate the issuing of transfers and prevent delay at transfer points, passengers are requested to ask for their transfers when paying fare and not to wait until they reach their transfer point. This rule is pretty generally followed out. When collecting fares the conductors usually carry a pad or transfers in their left hand ; their punch is attached by a chain or strap to a button or button-hole of their coat and hangs ready to their right hand.

Montreal Street Railway Company

Transfers *issued to* ______ *Line* ______

From ______ *office* ______ *day* ______ 190

RUN No.	BADGE	TRANSFER PAD No.						RETURNED AT RELIEF	
								No. to No.	No. to No.

RECORD OF TRANSFERS ISSUED TO CONDUCTOR

When required to issue a transfer, their fare box, which is carried in their right or left hand, according to the conductor, is transferred to the side, and held between the arm and body, thus leaving both hands free to manipulate transfers.

In collecting transfers, after verifying the correctness of time and direction punched, the conductor usually places them in his coat pocket, and when relieved takes them out, counts them, and places them in an envelope specially gotten up for the purpose, marks the number collected, also the first and last number, and total of transfers issued, and hands them in to the receiving clerk with his fare box. At different intervals, about once a week, a day's collections are thoroughly checked. All canceled or unused transfers are burned at the power house daily. This work is in charge of the company's comptroller, H. E. Smith, who kindly furnished the particulars for this article.

SINGLE-PHASE EQUIPMENT FOR THE CENTRAL ILLINOIS CONSTRUCTION COMPANY

The increasing favor with which single-phase equipment for the operation of interurban systems in the middle west is coming to be regarded is exemplified by the fact that within a few weeks two more companies have adopted single-phase equipment for the extensions of their lines. Mention has been made in these columns of the apparatus recently ordered for this purpose by the Milwaukee Light & Power Company, and the present article describes the equipment for the second of these two recent developments, that of the Central Illinois Construction Company. On account of the extended territory which this company eventually plans to cover, as well as the new construction now under way, the question of the proper system of distribution has called for a most careful investigation. As a result single-phase alternating current has been adopted for the additional 80 miles of track under construction, and its use is anticipated on future extensions. The portion of track to be so equipped consists of two 40-mile lines, one connecting Bloomington and Peoria, the other lying between Springfield and Lincoln.

The present equipment of the Central Illinois Construction Company is direct current, consisting of heavy suburban type cars equipped with four GE 75-hp motors. These cars consume considerable power when accelerating or when operating on grades. The cars contemplated for the new extensions are still heavier and it is evident that the question of secondary distribution is one of great importance when such large equipments are used over a system so extensive. There is now high tension distribution from the Riverton station at 13,200 volts, but this line is being changed to 33,000 volts, and the latter station will be supplemented by a second power house, located in Peoria, with a common 33,000-volt transmission line connecting the two stations.

After careful investigation into the merits of direct-current rotary converter and alternating-direct motor systems, the Central Illinois Construction Company had adopted alternating-current, single-phase motors on the new 80-mile extensions. The equipment comprises ten 75-hp a. c. compensated motor car equipments, made by the General Electric Company, together with necessary sub-stations, overhead line material, generating station equipment, etc. Each car equipment consists of four 75-hp motors with Sprague General Electric system of multiple-unit control adapted for use on alternating-current circuits. These are so arranged that they will permit tap control when running on alternating current, and series-parallel resistance control when running on direct current. In addition to the motors and control apparatus, complete a. c.-d. c. General Electric air compressors and straight air brake equipments will be installed, as well as arc headlights adapted for use on 25-cycle alternating current. The trolley will be of the pantagraph type with rolling contact, raised and lowered by compressed air.

The equipment just outlined will take care of the passenger service, but for hauling freight the operating company will employ a single-phase locomotive equipped for service on the same roads as the regular motor cars. This locomotive will be of the eight-wheel type, equipped with four General Electric 125-hp compensated alternating-current motors. The total weight of the locomotive complete will be 50 tons, with a draw bar pull of 20,000 lbs. It will haul its train at a speed of 20 m. p. h. with a current supply of 3300 volts and 25 cycles. In common with the motor cars for passenger service the locomotive will be equipped with the Sprague-General Electric multiple-unit control for operation on both direct and alternating currents. It will also be supplied with complete air brake equipment of the General Electric type, comprising an a. c.-d. c. motor driven air compressor with the straight air brake apparatus.

To furnish additional power for this new rolling stock, the present generating station at Riverton will be supplemented by a 2000-kw Curtis steam turbine, furnishing current at 25 cycles, and the new power house at Peoria will be equipped with two 2000-kw Curtis turbines. Additional machines will be installed as soon as other lines, now under consideration, are constructed. The generator and high-tension distribution system will be three phase and will feed the present rotary converter sub-stations, and also the 80-mile section of track operating with alternating current.

The alternating-current trolley will be 3300 volts of the well-known catenary type, suspended from brackets in the interurban sections and cross suspended through the small towns. Feeding the trolley, there will be four a. c. transformer sub-stations. Each sub-station will contain two 200-kw single-phase transformers with complete controlling high-tension and low-tension switchboard apparatus. These sub-stations will be placed approximately twenty miles apart and are so arranged that trouble in any sub-station will automatically cut out that station without affecting operation on the rest of the line. The complete electrical equipment for this line has been ordered from the General Electric Company.

A SIMPLE OIL CUP FOR RAILWAY MOTORS

In presenting the accompanying illustration of the railway motor oil cup, made by the American General Engineering Company, of New York, its simple construction is so apparent that it is hardly needful to say anything on that point. This cup lubricates on the "jolt" principle, that is, when the

OIL CUP, WITH CASE BROKEN AWAY TO SHOW INTERIOR

jolting or vibration due to the running of the car unseats the pin in the brass bushing oil will flow to the bearings through the hole in the side of the bushing. It will be noted that this cup contains no spring or other complex parts, the only moving piece being the pin mentioned. Even the felt washer shown is not required. Once the cup is filled with oil it needs no further attention for about forty-eight hours after the car is placed in service. The fact that many thousand specimens of this cup are in daily use shows that its merits have been recognized by the practical railway men who have had the opportunity to give it a thorough trial.

NEW RAIL-JOINT WORKS AT TROY

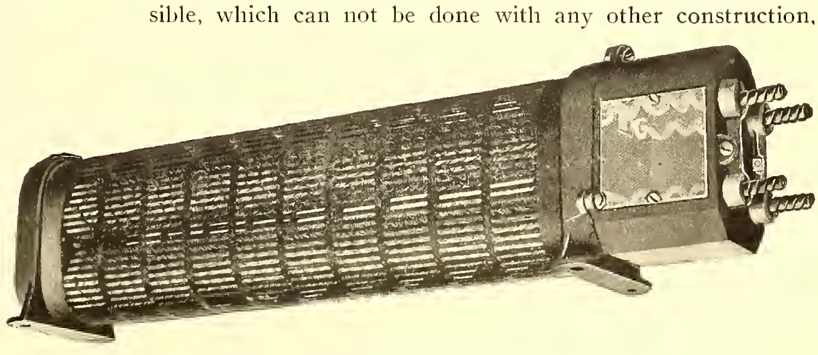
The Rail Joint Company has closed contracts for the enlargement and new equipment of its works at Troy, N. Y. These improvements will enable the company to double its output of previous years. The shops are now running day and night while the improvements are in progress to keep pace with the growing demands from steam and electric railways for the three base-supported rail joints known to the trade as the Continuous, Weber and Wolhaupter types for T and girder rail sections; also insulating and compromise or step joints to unite different sections of rails, maintaining a perfect surface, and doing away entirely with low joints. The general offices of the company are located at 29 West Thirty-Fourth Street, New York City.

ELECTRIC HEATER FOR CROSS-SEAT CARS, WITH JUNCTION BOX ATTACHED

The accompanying cut illustrates a double coil cross-seat heater with junction box attached, to the end of which the conduit is firmly held by two double clamps, designed by the Consolidated Car Heating Company, of New York. With this arrangement there can be no exposed wires and no joints outside of the heater.

The heat is distributed the full length of the heater on the several positions of the regulating switch. The heater coils consist of a large amount of low resistance wire, supported continuously on porcelain tubes absolutely to prevent vibration, thus making the insulation perfect under all conditions. Four hundred and fifty feet of wire is used in the heater coils of one heater of the above type when arranged for the minimum current consumption. The area of these coils is 542 sq. ins.; area of the porcelain supports, 170 sq. ins., or a total radiating surface, exclusive of the heater cases, of 712 sq. ins. per heater.

This construction permits the use of approximately ten times the amount of wire used in any other design of heater; supports the wire in such a manner that vibration is impossible, which can not be done with any other construction,



ELECTRIC HEATER WITH JUNCTION ROD ATTACHED

and by the use of this large amount of wire, the maximum temperature of the coils is but 400 degs. F. This is very much below the high resistance wires used in other heaters.

The Guatemala Tramway, Light & Power Company has received a charter from the State of New Jersey. The corporation proposes to build and operate public service utilities. The capital is $4,000,000.

GANZ STEAM MOTOR FOR THE ERIE RAILROAD

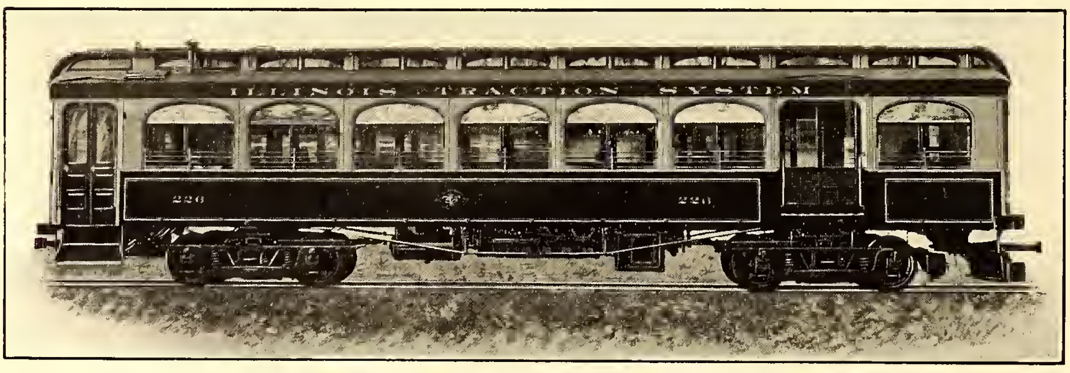
The Erie Railroad has ordered a Ganz railway steam motor car, which, it is expected, will be delivered early this summer. The steam machinery will be manufactured at the Ganz works in Budapest and the car body at the works of Barney & Smith at Dayton. In general outward appearance, this car will conform to the standard type of suburban car now used by the Erie road. The car body will be built of steel. The seating capacity will be about 56. The steam generator and accessories will be placed in a compartment 7 ft. long, at one end of the car, and this compartment will also contain the control-lever stand for the motorman. The motive power equipment will consist of one high duty water tube steam boiler, operating at a pressure of from 260 lbs. to 300 lbs., and supplying superheated steam to two 50-hp engines, both of which will be suspended from the forward truck frame. Each engine will drive a separate axle. It will be enclosed in a cast-iron case, partly filled with oil, so as to give a dust and dirt proof construction, as well as to provide continuous lubrication for the working parts. The engines and truck form a compact design similar in that respect to the motors and truck of an electric car. The engines and truck can also be removed and a reserve one quickly put in place.

This car will be 57 ft. long, over all, and will weigh about 40 tons in working order. The specifications call for a maximum speed of at least 38 m. p. h. on a level track and 15 m. p. h. on a 2 per cent grade. The car must also be capable of hauling a 35-ton trailer at a speed of 30 m. p. h. on a level track and 11½ m. p. h. on a 2 per cent grade. The fuel will be coke or anthracite coal, but provision will also be made for using crude petroleum.

A car similar to that just described, and also built by Ganz & Company, has just been put in operation on the Florida & East Coast Railway.

SOME FINE CARS FOR ILLINOIS LINES

The development of interurban lines in Illinois was begun at a later date than in some of the Eastern States, but in the last few years new extensions and new roads have been built with such rapidity that the map of the State now shows interurban lines connecting the majority of the principal cities, and especially is this so in the central portion. The car shown in the accompanying reproduction was built by the St. Louis Car Company for the Central Illinois Construction Company for use on the lines of the McKinley syndicate, which has taken the lead in the development of the Illinois lines. The cars are of the combination passenger, smoking and baggage type and are intended for operation in one direction only. They have a length over all of 51 ft. 6 ins., while the extreme width is 9 ft. 1½ ins.



ONE OF THE NEW STANDARD CARS OF THE ILLINOIS TRACTION SYSTEM

The interior of each car is divided into two compartments, the rear one for passengers, measuring 27 ft. 9¼ ins., while the forward compartment is 17 ft. 4 ins. long. The bottom framing is the St. Louis Car Company's standard for interurban cars, having side sills of yellow pine 5 ins. x 7¾ ins., reinforced by a steel plate ⅝ ins. x 7 ins. The center and intermediate sills are of 6-in. I beams filled on both sides with yellow pine fillers mortised to receive the tenons of the cross sills, which are of yellow pine 3½ ins. x 4 ins. in cross section. Steel angles, extending from the bumper to the body bolster, reinforce the heavy oak platform timbers. Diagonal braces are employed under the windows between the posts and the car is further braced by horizontal sheathing of ⅞-in. yellow pine under the side sheathing. Tie rods ⅝ in. in diameter at each post, and extending between the side sill and the side plate, tie the side of the car together. A sliding door is employed at the rear end of the passenger compartment and also in the sides of the baggage compartment, these latter doors being 4 ft. wide. Swinging doors are used in the interior of the car between compartments.

The mahogany finish of the inside of the car, together with the semi-empire ceilings, gives to the interior a very attractive appearance. The marquetry lines with which the mahogany finish is inlaid, together with the green opalescent glass in the deck sash, heighten the interior appearance of the car considerably. The ceilings are painted a light green and are tastefully decorated. Leather covered seats of the high back type are used in both passenger and smoking compartments. The car is arranged with a hot-water heater in the passenger compartment, while the toilet occupies a position near the rear of the car. A portion of the baggage compartment, the left-hand corner, is utilized as a motorman's cab. This contains in addition to air brake, a St. Louis Car Company bronze vertical wheel brake. The car body is mounted on master car builder's trucks and these are hung with four 75-hp motors. The car is arranged for multiple-unit control. Air sanders as well as multiple control is employed.

The first annual report submitted by the new board of directors of the West India Electric Company, at the annual meeting held in Montreal a few days ago, showed that very marked progress had been made. The gross earnings for the year amounted to $139,762.33, an increase of $8,595.08, or 6.55 per cent over the previous year. The net earnings amounted to $34,242.57, an increase of $6,111.39, or 10.09 per cent. The sum of $5,440.44 was written off for depreciation, leaving a balance at the credit of surplus account of $142,883.04. There has been a capital expenditure of $8,787.91, during the year. The indebtedness to the Bank of Montreal has been reduced from $58,288.54 to $23,426.38.

The directors entered office in March of last year, but it was not until July that they were able to effect the changes necessary for the improvement of the company's affairs. The following board of directors was elected: James Hutchinson, president; C. J. Fleet, K. C., vice-president; Hon. David MacKeen, W. Graham Browne, Henry Holgate, G. M. Webster, A. R. Oughtred.

ROLLING STOCK FOR NEW LINE BETWEEN CAPE GIRARDEAU AND JACKSON

The American Car Company has recently delivered three grooveless post semi-convertible cars, built under the Brill patents, to the Cape Girardeau-Jackson Interurban Railroad Company. This is a new corporation which has taken over the Citizen's Street Railway Company, of Cape Girardeau, and is extending the lines to Jackson, a distance of 8 miles. The present connection between these two points is by steam road, and so circuitous that nearly everyone drives between the two points. Jackson is the county seat and, therefore, there is considerable travel between Cape Girardeau and other places in the vicinity. The trolley extension will be a great benefit to the community, and as the territory is thickly populated, will doubtless pay well from the start. The present system in Cape Girardeau comprises 18 miles of tracks with ten cars in operation. An amusement park in the vicinity is reached by the lines. When the new power house is completed, the company will furnish power for lighting and motors. Cape Girardeau is about 100 miles south of St. Louis on the Mississippi River.

The accompanying illustration shows one of the new cars which is for service between Cape Girardeau and Jackson. The cars measure 20 ft. 8 ins. over the bodies and 30 ft. 1 in. over the vestibules; the width over the sills, including the panels,

SINGLE-TRUCK CAR FOR THE CAPE GIRARDEAU & JACKSON INTERURBAN RAILWAY

is 7 ft. 9½ ins., and over the posts at the belt, 8 ft. 2 ins.; sweep of the posts, 2¾ ins.; centers of posts, 2 ft. 5 ins; from the floor to the ceiling, 8 ft. 4½ ins.; from the track to the under side of the sills, 2 ft. 6⅝ ins., and from the under side of the sills over the trolley-board, 9 ft. 1¼ in.; height from the track to the platform step, 15½ ins., and from the step to the platform, 12 ins.; length of the seats, 34 ins., and width of the aisle, 21½ ins. The side sills are 3⅜ ins. x 5 ins., and the end sills, 3½ ins. x 6 ⅝ ins.; wheel pieces, 4¼ ins. x 5 ins., and the angle iron sills, 3½ ins. x 6 ins. The cars are finished in cherry with ceilings of three-ply birch veneer decorated. The incandescent lights are placed against the head lining under the side roofs and the bulbs are of frosted glass. Being over the seats, the lights are not cut off from seated passengers by those standing in the aisle. The seats are of Brill manufacture with pushover backs with corner grab handles and tilting cushions. The seating capacity is thirty. Other specialties of the same make with which the cars are equipped are automatic vestibule folding door controllers, stoves, angle iron bumpers, "Dedenda" gongs, retriever signal bells and trucks of the No. 21-E type. The truck wheel base is 7 ft. 6 ins., 33-in. wheels and 4-in. axles. Two 30-hp motors are used per car. The weight of a car and trucks without the motors is 15,300 lbs. and with motors and complete equipment, 20,700 lbs.

ARC HEADLIGHT FOR INTERURBAN RAILWAYS

With the extension of interurban railways a demand has been created for a more powerful headlight than the usual form equipped with an incandescent lamp. To meet this demand an arc headlight has been produced by the General Electric Company which can readily be fastened to the dashboard of the car and transferred from end to end, as may be required. This headlight illuminates the track so effectively that there is no difficulty in distinguishing as many as fifteen

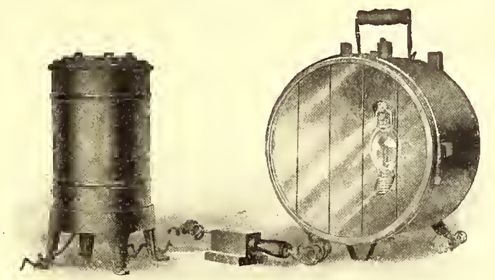


FIG. 1.—ARC HEADLIGHT WITH RESISTANCE

poles along a line where the poles are placed 100 ft. apart, giving a distinct illumination for approximately 1500 ft. ahead of the car, as shown in the illustration, Fig. 2, which is reproduced from a night photograph. The new headlight, which is shown in Fig. 1, is about 15 ins. in diameter and 9 ins. deep, and consists of a sheet steel casing, re-inforced by the iron door casting, making a rigid structure. Contained in this casing is an arc lamp of special design, equipped with an enclosing globe of heat-resisting glass and mounted with the arc at the focus of a nickel-plated copper reflector. The whole construction is simple, convenient and durable.

As the design of cars varies greatly, no attempt has been

FIG. 2.—SHOWING EFFECTIVE TRACK ILLUMINATION

made to furnish a hanger for attaching the headlight to the front of the car. The headlight is provided with hooks and adjusting screws, so placed that little difficulty will be found in arranging a suitable hanger, and it has been left to the purchaser to attend to this detail as suits him best.

Special care has been used in the design of the door of the headlight, the frame of which is an iron casting swung on a substantial hinge. The door is locked shut by a wing nut which prevents any possibility of its swinging open while on the road. The glass front is made in sections, for the purpose of avoiding breakage by taking up the jar and by eliminating the strains, due to expansion and contraction, to which a one-piece glass front would be liable. These sections are held in place by an asbestos covered iron ring which can readily be removed. When desired, a screen can be furnished which may readily be attached to the front of the headlight, over the glass, in such a position as to diminish the light when running within city limits. Attached to each headlight by a flexible cable is a plug which furnishes a convenient connection with a socket at either end of the car. The upper carbon is connected to the plug and made positive, while the lower carbon is grounded to the frame of the lamp.

The lamp mechanism, shown in Fig. 3, is of exceedingly simple and durable construction, designed to give good service under the exacting conditions imposed by the use of the headlight on the front of a car moving at a high speed. This mechanism is not of the regulating type but is arranged to pick up against a positive stop, no attempt being made to maintain the arc automatically at the pick-up voltage. The lamp consists of a hand adjusting device for the lower (negative) carbon, and a feeding mechanism for the upper (positive) carbon, mounted on a light but rigid back-plate which is screwed to the back of the headlight casing.

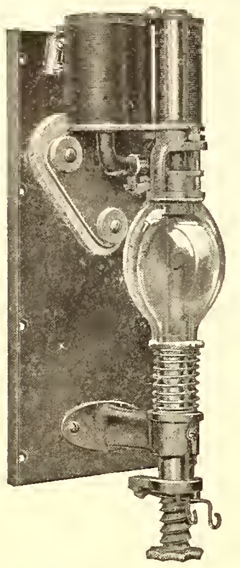


FIG. 3.—DETAILS OF LAMP MECHANISM

The lower carbon is supported on a metal bracket secured directly to the back-plate. The carbon is carried at the end of a threaded rod, the threads of which are engaged by wire guides, as shown. By this arrangement the lower carbon may be adjusted manually from time to time (once an hour is sufficient) in order to keep the arc at the focus of the reflector. The bracket also carries a coil spring with an asbestos-covered ring at its top which supports the lower end of the enclosing globe securely, yet permits its easy removal. This flexible support obviates all danger of breaking the enclosing globe by the vibration of the car, etc.

Referring now to the upper carbon support: A metal base, insulated from the back-plate, carries a guide for the carbon, a pair of solenoid coils connected in series with the arc and arranged to operate a clutch, and an asbestos-covered ring support for the upper end of the enclosing globe. The clutch is specially designed to grip the upper carbon (which has no holder), and maintain it at the proper arc distance from the lower carbon, and does not allow the carbon to slip whatever may be the vibration of the car, as in going over frogs, etc. As already described, the lower carbon is fixed, except for the manual adjustment above referred to. The feed of the upper carbon is effected by the release of the clutch caused by the occasional opening of the circuit incidental to the running of the car. A momentary loss of contact between the trolley wheel and the line, for example, releases the clutch,

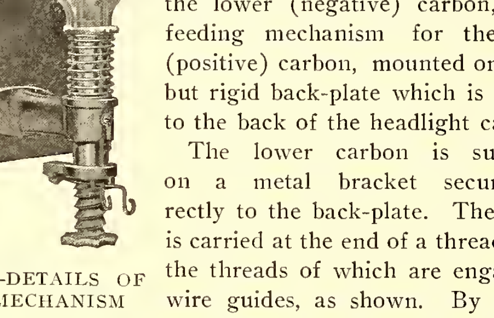


FIG. 4.—WIRING DIAGRAM, SHOWING HOW HEADLIGHT CAN BE TURNED ON OR OFF WITHOUT INTERFERING WITH THE INCANDESCENT LAMPS

allowing the upper carbon to fall into contact with the lower carbon. Upon restoration of the circuit the clutch picks up the carbon to the fixed arc distance. It will be seen that this form of feed is not only simple in the extreme, but is far more practical for use in a car headlight than would be the mechanism of an ordinary arc lamp. From experience it has been found that the interruption of the lamp circuit caused by running from one section to another, etc., occurs sufficiently often to give the necessary feed.

The trimming of the lamp is readily accomplished, as the carbons can be placed without opening the casing or removing the globe. The carbons used are ⅜ in. in diameter with a life of from eighteen hours to twenty-four hours, depending largely upon the care taken in trimming, frequency of feed and other circumstances of the use of the headlight. The lower carbon and its holder may readily be removed by pinching together the wire guides which engage the threads of the carbon holder, allowing the lower carbon and holder to drop down through a hole in the bottom of the casing, followed by the upper carbon. After placing a lower carbon of proper length in the holder, and adjusting this carbon to the focus of the reflector, it is only necessary to drop the new upper carbon through an opening in the top of the lamp provided for the purpose.

The arc is designed to take 4 amps., and to pick up an 80-volt arc. In order to take up the difference between the line voltage and the arc voltage, a resistance, shown in Fig. 1, is furnished. This resistance unit has a sheet steel casing, and is of substantial construction, with feet for securing the unit to the bottom of the car.

While the use of such a dead resistance gives satisfactory operation of the headlight, it is recommended that incandescent lamps for lighting the interior of the car be employed instead, thereby utilizing the energy represented by the difference in voltage between line and arc. Different combinations of incandescent lamps can be used to make up the resistance, according to the number of lamps required to light the car. One very satisfactory combination is a group of 16 32-cp 110-volt lamps, consisting of four series of four lamps each, connected in multiple. If it is desired to increase the number of lamps in the car, 32 16-cp lamps may be used, in eight series of four lamps each, connected in multiple.

If it is desired to keep these incandescent lamps burning when the headlight is removed, or while it is being transferred from one end of the car to the other, a substitutional resistance-unit may be employed, wired up to a pair of two-way snap switches, one placed at each end of the car, as shown in the diagram, Fig. 4. This arrangement permits the headlight to be turned on or off without interfering with the incandescent lamps.

When the Lake Shore Electric Railway places its summer schedule in operation, about May 1, it will add two limited trains between Cleveland and Toledo, making five limiteds each way, in addition to hourly through service and half-hourly from Cleveland to Lorain and Toledo to Fremont. The tremendous business on the limiteds has been responsible for the gains made by this company. Much of the time these cars have been double-headed and they have earned from 40 cents to $1 per car mile. The new cars ordered a short time ago from the Niles Car & Manufacturing Company will be placed in the limited service. They will have no baggage compartments and will have a seating capacity of 56 people. There has been much talk of running chair cars through from Cleveland to Detroit, but the small seating capacity of the cars makes such a step undesirable.

FINANCIAL INTELLIGENCE

Wall Street, March 28, 1906.

The Money Market

There has been very little change in the monetary situation during the past week. The demand for money from stock commission houses has been extremely light, owing to an inactive securities market, but at the same time there has been no disposition on the part of lenders to press their funds, the belief being pretty general in banking circles that more remunerative rates will be obtained at the end of the month, as a result of the calling and shifting of loans preparatory to the April 1 interest and dividend disbursements, which are estimated at about $40,000,000, a large part of which will be disbursed by the New York City banks. Thus far the local institutions have lost substantially in cash to the sub-treasury, but, nevertheless, the clearing house banks are in a stronger position than for some time past, and any advance in interest rates arising from the quarterly disbursements above referred to will be only temporary. Otherwise the developments of the week have been in favor of an easier market. The demand for funds at the principal Southern and Western cities shows some falling off, and it is expected that the return flow of money from the interior will be under way in the near future. The foreign markets have been somewhat easier, owing to the amicable settlement of the Moroccan controversy. Foreign exchange has ruled around the gold import rate practically throughout the week, but the disposition on the part of foreigners to keep their supply of gold intact makes it extremely difficult for local bankers to draw supplies of gold from any of the principal European centers. At the close, rumors were current that a substantial amount of gold had been secured in the Berlin market for shipment to New York, but while official confirmation of the transaction was not forthcoming, the general opinion in banking circles appears to be that further engagements of the yellow metal in Berlin may be expected. The bank statement, published on last Saturday, was far better than was generally expected. The increase in loans was only $3,901,200. Cash increased $1,549,300, which was about $900,000 larger than indicated by the preliminary estimates. The reserve required was $1,050,600 larger than in the preceding week, which, deducted from the increase in cash, resulted in an increase in the surplus reserve of $498,650. The surplus now stands at $6,363,775, and compares favorably with the reserve held by the banks in the corresponding period in former years. In 1905 the surplus was $6,479,325, as against $27,468,875 in 1904, $6,280,900 in 1903, $6,965,575 in 1902, $7,870,500 in 1901, and $5,817,300 in 1900.

Money on call has loaned at 5 and at 3 per cent, the average for the week being about 4¼ per cent. Sixty and thirty-day funds were obtainable at 5 to 5¼ per cent, while four to six months' maturities were offered at 5 per cent. Commercial paper was quiet and unchanged, 5¼ per cent being the minimum for prime indorsements.

The Stock Market

There has been a decided improvement in the securities market during the past week. Not only have the dealings upon the Stock Exchange been upon a somewhat larger scale, but they have been accompanied by a general rise in values. At times the market was subjected to heavy selling to realize profits, but the absorption was good, and at the close of the week the final prices ruled well above the recent low level. A noteworthy feature of the week has been the elimination from the situation of many of the adverse influences which have heretofore acted as deterrents to bullish speculations. The most important of them has been the pacific settlement of the Moroccan controversy, which was followed by rather liberal buying of our securities for foreign account. The money market continued to work easier, and rates for foreign exchange declined to a point which makes probable further engagements of gold in the European markets for import to this country. In addition to this the reports regarding the spring wheat crop were favorable, and the railway traffic returns continued to show substantial increase over those for the corresponding period of last year. The most important of these was the statement of the Lake Shore for the year ended Dec. 31, 1905, which showed heavy increases in both gross and net receipts. About the only unsettling factor was the uncertainty regarding the outcome of the conference between the coal operators and the miners. Just before the close of the week the announcement that the sub-committee of the soft coal interests, in session at Indianapolis, had disagreed on the wage scale, caused some selling, which carried prices off sharply, but this was counterbalanced by the action of the directors of the Anaconda Copper Company in declaring a dividend of $1.12½, or 4¼ per cent for the quarter, thus placing the stock upon an 18 per cent basis. The outcome of the contest between the anthracite coal operators and the miners is still very uncertain, but the prevailing opinion in Wall Street is that there will be no strike, and that even if there should be it will result in certain defeat for the miners. However, there is a disposition on the part of the larger interests to await the final settlement of the matter before inaugurating any aggressive bullish operations.

There has been very little interest in the local traction stocks apart from Brooklyn Rapid Transit, which has been strongly maintained as a result of pool operations, backed up by the large and increasing earnings and the strong financial position of the company.

Philadelphia

Although the dealings in the traction shares have been upon a somewhat smaller scale during the past week, prices have displayed firmness, and in most instances the final figures showed fractional net gains over those ruling at the close of last week. Philadelphia Rapid Transit was about the only prominent stock to sustain a loss in price. Early in the week the failure of the Mayor to sign the ordinance granting the company an extension of time for the completion of the Market Street subway caused some selling, which carried the price off 1⅝ to 27½, but on the way down all offerings were readily absorbed, and at the close there was a rally to 28½. Upwards of 16,000 shares were traded in. Philadelphia Company's issues also were in good demand, trust companies' receipts, representing about 12,000 shares of the common stock, changing hands at from 53⅝ up to 54½, while the preferred receipts sold at from 50⅜ to 49¾, and back to 50. The undeposited common stock brought prices ranging from 51¼ to 50¾, and back to 51. Other transactions included American Railways at 51¼ and 51½, Consolidated Traction of New Jersey at 81, Inter-State Railways at 100½, Philadelphia Traction at 99⅛ and 100, Union Traction at 62¼ and 62, United Traction of Pittsburg preferred at 50, Fairmount Park Transportation at 18½, Railways General at 6½, United Companies of New Jersey at 265 ex. dividend, and United Traction of Indiana at 34.

Chicago

Trading in the local street railway issues was less animated this week, but prices in several instances sustained further sharp recessions. In the early dealings there was a recovery in prices of both North and West Chicago stocks, but the improvements were only temporary. North Chicago, after a rise from 39 to 40½, broke to 32, while West Chicago, after selling at 39¾, ran off to 28. Chicago City Railway stock sold at 155 for 100 shares, and transactions in Chicago Union Traction common and preferred were made at 6 and 18 and 18¾, respectively. The elevated stocks were quiet but firm, except South Side Elevated, which declined from 95 to 94. Chicago & Oak Park sold at 6¾ and 7, and the preferred brought 25 and 26. Metropolitan sold at 27½.

Other Traction Securities

Trading in the Baltimore market was confined almost entirely to the United Railway issues, all of which were moderately active and strong. The free stock sold to the extent of 700 shares, at 18⅛ and 18¼, while upwards of 1500 shares of the pooled stock brought prices ranging from 18⅝ to 18¾. The 4 per cent bonds were practically unchanged, all transactions in them taking place at 92⅜ to 92½, but the free and pooled incomes displayed strength, upwards of $150,000 of the first-named changing hands, at 75½ and 74¾ and 75, while about $160,000 of the last named brought prices ranging from 74½ to 73½, and back to 73⅞. Other transactions included City & Suburban 5s at 112¾, and Norfolk Railway & Light 5s at 100¼ and 100. The Boston market was dull and irregular. Boston Elevated, after declining from 154¾ to 154, advanced to 155½ on limited purchases. Boston & Worcester common rose from 34½ to 35, and the preferred sold at 84. Massachusetts Electric fluctuated between 19 and 20, while the preferred sold from 69 to 70, and back to the opening figure. West End opened strong, with sales at 100, but subsequently there was a reaction to 98. The preferred sold at 115¼ for a small amount. Trading was very quiet in the New York curb market. Interborough Rapid Transit receipts sold to the extent of about 2000 at 227 and 229, an advance of 4 points. Interborough-Metropolitan issues were irregular, about 12,000 shares of the common changing hands at from 50¼ to 52, while about 1000 shares of the preferred sold at 86 and 87½. The 4½ per cent bonds were unusually quiet, about $80,000 selling at from 90¾ to 90⅜. New Orleans Railway common was somewhat firmer, 700 shares being dealt in at 36½ and 36. Public Service Corporation certificates brought 74 for $12,000. Lake Shore Electric common showed considerable activity in Cleveland last week, several hundred shares selling with an advance from 16½ to 16⅞. Cleveland Electric was weak, under offerings following the closing of the books for dividends, selling down from 76¾ to 75¾. Aurora, Elgin & Chicago received considerable attention on account of the ratification of the merger of the allied properties, and the common sold up to 35¼, with a lot of the bonds at 99 and 99¾. There was considerable trading in the underwriting of the Washington, Baltimore & Annapolis Railway at around 106½.

Security Quotations

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

	Mch. 21	Mch. 28
American Railways	50¾	51½
Boston Elevated	154¼	155
Brooklyn Rapid Transit	83¼	84
Chicago City	*150	150
Chicago Union Traction (common)	5⅝	6⅜
Chicago Union Traction (preferred)	21½	21½
Cleveland Electric	81	81
Consolidated Traction of New Jersey	80½	80
Detroit United	99	99½
Interborough Rapid Transit	228	227
Interborough-Metropolitan Co. (common), W. I.	50¾	51⅛
Interborough-Metropolitan Co. (preferred), W. I.	87	87¼
Interborough-Metropolitan Co. 4½s, W. I.	90¼	90¼
International Traction (common)	36	37½
International Traction (preferred) 4s	72	72
Manhattan Railway	157	157½
Massachusetts Elec. Cos. (common)	19	19
Massachusetts Elec. Cos. (preferred)	68½	68
Metropolitan Elevated, Chicago (common)	27	26½
Metropolitan Elevated, Chicago (preferred)	68	68
Metropolitan Street	112¾	112
Metropolitan Securities	71	71
New Orleans Railways (common)	35½	35¾
New Orleans Railways (preferred)	82¼	81½
New Orleans Railways, 4½s	89	89
North American	99½	99⅜
North Jersey Street Railway	27	27
Philadelphia Company (common)	50½	51¼
Philadelphia Rapid Transit	29⅛	27¾
Philadelphia Traction	99½	99
Public Service Corporation 5 per cent notes	94	94
Public Service Corporation certificates	72½	73¼
South Side Elevated (Chicago)	94	93
Third Avenue	132	132
Twin City, Minneapolis (common)	116¼	116
Union Traction (Philadelphia)	62	61¾
West End (common)	99½	99
West End (preferred)	114	114

* Ex-dividend. a Asked. W. I., when issued.

Metals

The pig iron market continues quiet. New business is light, the leading interests being disposed to await the outcome of the conference between the anthracite coal operators and the miners. The mills are running full and have sufficient orders to keep them busy for some time to come. Foundry iron is also quiet, but firm. The demand for steel and steel products is good. Steel rails are in active demand, and indications point to the placing of some large orders in the near future. The position of copper metal is very strong. Stocks are low, and as the demand is increasing, higher prices are looked for. Quotations for spot copper are as follows: Lake, $18.50 to $18.75; Electrolytic, $18.25 to $18.50; castings, $18 to $18.25.

ERIE'S ELECTRIFICATION PLANS FOR CENTRAL NEW YORK

Further important announcements were made Wednesday, March 28, by the Erie Railroad, regarding its plans for electric operation. They concern arrangements made for internal operation in New York State, and were to the effect that surveys and estimates would be made at once for the electrification of the Rochester division from Corning to Rochester, and that power for the operation of this line would be secured from Niagara Falls. Already the company is at work on the plans for electrifying its line from Corning to Schenectady, power to be supplied from a plant now building by the company at Hornellsville.

GETS FREIGHT RIGHTS

The Old Colony Street Railway Company, of Boston, has been granted the rights to operate freight service in about twenty-five cities and towns, these being nearly all that were petitioned. The company is now at work on the matter of terminals in Taunton and Brockton, and has arranged with the Rhode Island Company for a terminal in Providence. Rights approved by the Board of Railroad Commissioners are from Brockton to Providence, through Easton, North Raynham, Taunton, Rehoboth, to Providence. It is proposed to start the operation of this service April 1. As soon as defined routes can be laid out, and the Commissioners approve them, it is the intention of the company to extend the service over the entire system, including Boston, Brockton, Taunton, Providence, Fall River, New Bedford and the various towns along the routes connecting these cities.

BASIS OF THE EAST ST. LOUIS CONSOLIDATION

Announcement was made March 23 of the merging of the East St. Louis & Suburban Railway and the Alton, Granite City & St. Louis Company, which connects St. Louis with a score of Illinois towns and cities within a radius of 40 miles. The deal was conducted by E. W. Clark & Company, of Philadelphia. The official circular states that the stockholders of the two companies have agreed on a consolidation of interests and that the new company will be incorporated with a capital stock of $14,000,000. Of this, $7,000,000 will be 5 per cent preferred stock, cumulative from May 1, 1906, and $7,000,000 common stock. For each of the 50,000 shares of stock of the East St. Louis & Suburban Company, one share of preferred stock and one share and one-twentieth of common stock of the new company will be issued. The capital stock of the Suburban has been $5,000,000 and of the Alton & Granite $2,500,000, a total of $7,500,000. For each of the 5000 shares of preferred stock of the Alton, Granite & St. Louis Company, one share of preferred stock and one-fifth of a share of common stock of the new company will be issued. For each of the 21,500 shares of common stock of the Alton, Granite & St. Louis Company, one-half a share of the preferred and six-tenths of a share of the common stock of the new company will be issued. Of the preferred and common stock of the new company, 4250 shares of the preferred and 3600 shares of the common will be delivered to E. W. Clark & Company for $425,000 in cash for deposit in the treasury of the new company, of which Clark & Company will have management and control. The earnings of the two companies for the year 1905 operated separately were more than sufficient to pay the entire fixed charges and dividends on the new preferred stock. It is estimated that in 1906 the combined system will earn a substantial surplus over all fixed charges and the regular quarterly dividend on the preferred stock.

AFFAIRS IN CHICAGO

At the conferences between the principal owners and counsel of the Chicago traction companies held in New York recently, according to W. W. Gurley, general counsel for the Union Traction Company, nothing definite transpired. One of the important questions to be settled is whether an appeal shall be made to the Supreme Court for a rehearing of the ninety-nine-year case. Mr. Gurley said:

"What we did practically amounted to nothing. We could not do anything until we got the full decision of the court, and that has not been handed down yet. We should have it by April 2, however, and then we will know more. One reason for wanting to see the decision is to be able to decide on the grounds on which we will base our petition for a rehearing. Naturally we will have to get the reasons of the court before we will know what to say in asking it to reverse its decision. Again, it is possible that the decision is not so bad as it looks now. The reasons the court gives for its conclusions may hold some hopes out to us. Anyway, we want to find out."

The Chicago Union Traction Company is ready to begin work on the lowering of the Washington Street and La Salle Street tunnels, should the government insist on their removal by April 15. Because of the possibility of a rehearing in the "ninety-nine-year case," Mayor Dunne has refused to permit the company to erect overhead construction for the operation of cars by electricity through the loop district while the tunnels are being lowered. Mr. Gurley, speaking for the company, said it is ready to convert the cable lines for electrical operation as soon as the city grants permission. The work would cost $1,000,000. He said further that the company had contingent contracts for electric car trucks and all other necessary material, and could begin work of changing to electrical operation the day permission is given. He estimates the work of changing over the system would require about eight weeks, but with everything favorable, it might be accomplished in a shorter time. City Engineer Shaw has plans in readiness for the lowering of the tunnels. A new top will be built below the present roof, and the old arch removed.

The Northwestern Elevated Railroad, of Chicago, demands a change in the recently passed ordinance permitting the electrification of the Evanston branch of the Chicago, Milwaukee & St. Paul Railroad and the operation of cars jointly over the St. Paul and the Northwestern Elevated tracks. The clause objected to provides that the company shall enter into a contract with the city to rearrange its downtown terminals and loops at any time and in any manner the city may demand. The clause is said to be in furtherance of a plan of Mayor Dunne to provide for through routeing of the elevated trains from one end of the city to the other.

A plan to relieve congestion on the downtown loop proposed by the Northwestern Elevated and submitted to the Mayor, contemplates the construction of an extension from the main line at Kinzie or Michigan Street, which will cross the river at Dearborn or State Street and terminate in a stub end at Lake Street. Such an extension would permit a number of trains to be diverted from the loop entirely, and passengers, by boarding the cars at the new terminal, would not be compelled to ride around the loop. The Northwestern Company states that if permission is given to construct this branch, it is willing to agree to give the city the power to rearrange its loop trains and terminals as the city may see fit.

A conference was held on Saturday between Clarence E. Knight, representing the Yerkes estate, and Mayor Dunne, at which it is said a formal offer was made for the sale of the holdings of the late Charles T. Yerkes in the underlying corporations of the Union Traction Company to the city. Neither the Mayor nor Mr. Knight would commit himself regarding the conference, and the stories in circulation regarding the overtures are all mere conjectures. It might almost be said that they are as different as they are extensive. One of the papers, however, had the temerity to publish the following, as coming from a close friend of the Mayor:

"The proposition which Mr. Knight made to Mayor Dunne was to get rid of the Yerkes holdings in traction securities and hand them over to the city to aid it in obtaining municipal ownership, providing the people vote for the public proprietorship of the street railway lines a week from next Tuesday. The holdings are said to be considerable in the two big companies which directly underly the Union Traction Company, as well as to include all the bonds outstanding against the Consolidated Traction Company. The proposal contemplates payment in cash or in Mueller certificates, providing only that they are voted by the people on April 3 and then declared legal by the Supreme Court of the State."

SALE OF NATIONAL ELECTRIC PLANT

A despatch from Milwaukee, Wis., says the plant of the National Electric Company, including all assets, was sold March 26 at the office of John S. Maxwell, referee in bankruptcy, to Chas. L. Sullivan, of Chicago, for $500,000. The statement of Receiver John I. Beggs showed assets of $1,350,691 and liabilities of $1,242,000. Creditors will, it is stated, receive approximately 40 per cent of their claims.

JERSEY FREIGHT BILL IN GOVERNOR'S HANDS

The bill to permit the electric railways operating in New Jersey to transport freight is now in the Governor's hands for approval. The measure passed the Senate some time ago, was sent to the Assembly and amended, was returned to the Senate and there passed March 21 in its amended form. The bill amends the act of 1896, which expressly prohibited street railway companies from carrying freight or express matter over their roads in any city, town, borough, village, township or other municipality in this State. The bill originally provided that the old law should not prevent such companies from carrying freight or express matter in and through any city or municipality by and with the consent of the governing body of such municipality, and under such lawful restrictions and regulations as such governing body may deem the interests of the public require. The Assembly amendment provided that the consent of the governing body must be given by ordinance. In this form the bill now awaits the Governor's action.

A CALIFORNIA DEAL CONFIRMED

General M. H. Sherman, formerly vice-president of the old Los Angeles-Pacific Railroad Company, which has just been succeeded by the Los Angeles-Pacific Company, confirms the report of the sale of that company's property to E. H. Harriman, of the Southern Pacific. Although there has been a change of ownership, according to Gen. Sherman there is to be no change in management, at least not at present. General Manager Gabel will continue in his present position, while Gen. Sherman and President E. P. Clark will direct the policy of the company, as heretofore. The confirmation of this story was first found in a document filed with the county clerk of Los Angeles County on March 14, reporting the action of the stockholders of the Los Angeles-Pacific Company in voting upon the proposition to create $12,500,000 of bonded indebtedness. According to that certificate, Epes Randolph, representing E. H. Harriman, holds 76,500 shares of the company's $150,000 capitalization, while one W. F. Buffum, a clerk, has 73,489. The other stockholders represented in the meeting were E. P. Clark, 1 share; R. P. Sherman, 1 share; John D. Pope, 1 share; M. E. Hammond, 1 share; R. P. Gillis, 1 share; A. I. Smith, 1 share, and five others 1 share each. The absence of the name of Gen. Sherman from this list is explained by the statement that he resigned from the directorate in February. His interests are represented by his son, R. P. Sherman. According to the certificate of bonded indebtedness, the bonds just voted have forty years to run and bear interest at 5 per cent, payable semi-annually, secured by trust deeds or mortgages on all the property of the company now owned or hereafter acquired during that time. Bonds amounting to $5,000,000 are to be used in retiring a similar amount of bonded indebtedness of the Los Angeles-Pacific Railroad Company, one of the corporations which recently formed the Los Angeles-Pacific Company by consolidation and amalgamation; $2,500,000 of bonds are to be used in the payment of all outstanding liabilities of the Santa Monica Canyon Railroad Company, and the remaining $5,000,000 of bonds is to be used in making and paying for improvements, extensions, betterments, additional equipments, and in acquiring other property. The Union Trust Company, of San Francisco, has been appointed trustee of the above mentioned trust deed. The total number of shares of the Los Angeles-Pacific Company is 150,000. The certificate of bonded indebtedness is verified by E. P. Clark, president, and A. I. Smith, secretary of the Los Angeles-Pacific Company. In San Francisco on March 9, $1,000,000 of the new bonds sold at $100.25.

JERSEY TUNNEL PLANS—THE HIGH-SPEED LINE TO NEWARK

It is announced that the high-speed electric railway between Newark and the downtown part of New York, which was projected some time ago by the McAdoo interests, is to be built. The road. is designed to give a 15-minute connection between Newark and the City Hall, New York, and, as described in the STREET RAILWAY JOURNAL for Nov. 25, will be constructed over the Pennsylvania's right of way, and will have a connection with the Pennsylvania at Harrison Street, Newark.

A twenty-two story terminal station is being erected at Church and Fulton Streets, New York, and, while there will be no connection for trains between the McAdoo tunnel and the Interborough lines, there will be a subway for passengers connecting the McAdoo terminal with the Interborough station at Fulton Street. The Newark line is to cost $6,000,000. In connection with it the new financing plans of the McAdoo tunnels are made known. The four companies formed to build the upper and lower tunnels of the McAdoo system will be merged in the Hudson & Manhattan Railroad Company, which will have an authorized capital of $10,000,000 5 per cent preferred stock and $40,000,000 common stock. In addition there will be an issue of $50,000,000 4½ per cent fifty-year first mortgage bonds, convertible into common stock at 110. The new company is to be the operating company for the system, and part of the bond and stock issues is to be used to pay the Hudson Companies, which was the construction company. Of the $10,000,000 preferred stock, $5,250,000 has already been issued, and it is understood that this has gone into the treasury of the Hudson Companies. The organization of the new company has not been completed, but the officers and directors will be identical with those of the companies already in existence. Harvey Fisk & Sons are financing the company. The bonds are offered at par, with a bonus of 25 per cent in common stock. A map of the McAdoo system just issued shows connections with the Erie and Delaware, Lackawanna & Western Railroad terminals in Jersey City.

YOUNGSTOWN & OHIO RIVER RAILROAD

The Youngstown & Ohio River Railway Company, which is being projected by Will Christy, J. R. Nutt, George Stanley, Max Goodman, Warren Bicknell and other well-known Cleveland people who have built a number of important roads in the Central West, will have a capitalization of $2,500,000 of common stock and $2,500,000 5 per cent twenty-year gold bonds. Of the stock, $1,700,000 will be issued immediately, while the bonds to be issued will be $1,500,000. It is thought it will cost about $1,500,000 to build the road, which will have a mileage of 56 miles. The main line will extend from Youngstown to East Liverpool, Ohio, by way of Canfield, Greenford, Washingtonville, Leetonia and Lisbon, and there will be a branch line from Washingtonville to Salem and one from Leetonia to Columbiana. At Youngstown the line will connect with the Pennsylvania & Mahoning Valley for Cleveland, while the Stark Electric Railway at Salem will also give another connection for Cleveland. The total population of towns along the line is 113,545, exclusive of rural population. There are no steam roads between the points mentioned, and the line will have practically no competition at any point. The company has acquired coal property, and the power house will be located at the opening of its own mine. The construction of the road will be such as to permit its handling coal to all terminals. The road will be built by the Cleveland Construction Company, Citizens' Building, Cleveland. The proposition has been practically all financed in Cleveland, and it is announced that active construction work will start as soon as possible.

GASOLINE CAR ORDER STORY DENIED

Officials of the Lake Shore & Michigan Southern Railroad deny there is any truth in the report printed in the daily papers a few days ago and given wide circulation that the company is building seventy-five gasoline-electric cars at its Collinwood shops or any place else. They state that they will not undertake to build any more of these cars until the experimental car now under construction at Akron has been tested out and found satisfactory.

MIXED SYSTEM IN SAN FRANCISCO

As the result of protracted conferences between President Calhoun, of the United Railroads of San Francisco, and representatives of the Society for the Adornment of San Francisco and the Sutter Street Improvement Club, a compromise has been effected with relation to the street railway situation whereby Mr. Calhoun agrees to provide an underground electric conduit system on Market Street as far as Valencia Street, and on Sutter Street as far as Polk Street, and will be permitted to replace the cable system with the overhead trolley in other portions of the city without opposition on the part of the associations named. In the STREET RAILWAY JOURNAL for Jan. 6, 1906, will be found an extended reference to a report by William Barclay Parsons to the Merchants' Association of San Francisco, recommending a general plan for improving and developing the city's transportation facilities.

NORTHERN ELECTRIC RAILWAY IN CALIFORNIA

At a recent meeting of the Northern Electric Company, which is building a new electric railway between Chico and Oroville, in San Francisco, Henry A. Butters was elected president. The board of directors includes J. Downey Harvey, Louis Sloss and E. R. Lilienthal, and the company, organized a year ago, is capitalized at $6,000,000. All the men interested in the road are of San Francisco. Mr. Butters has been the promoter in the enterprise from the start. Until the present time the others having connection with the undertaking were not known to the public. The Northern Electric Company has offices in the Shreve Building and David S. Edwards is the secretary. The road from Chico to Oroville will do a general passenger and freight business. The operation of cars will begin some time in April. At Chico the road will connect with the Southern Pacific and at Oroville with the Western Pacific. The new road, in addition to passing through a rich country, will greatly shorten the distance from Chico to Oroville, which is now mostly covered by stage. The line is 24 miles in length. Branch lines to Marysville, Meridian, Colusa and Red Bluff are contemplated. The company also plans to extend the line from time to time, building north and South in the Sacramento Valley. A road from Marysville to Sacramento has also been considered. Actual work on the roadbed of the Northern Electric Company's line was started last summer from Oroville.

FREIGHT A GUBERNATORIAL ISSUE IN PENNSYLVANIA

The question of the transportation of freight by electric railway in Pennsylvania gives promise of becoming a feature of the next campaign for Governor. At the Republican convention of Delaware County, on March 15, State Treasurer William L. Mathues was indorsed for Governor, and a platform was adopted favoring legislation to permit the electric railway companies to carry freight. Even the nominees for the Legislature, including Thomas V. Cooper, known as the floor manager for the railroad interests, pledged themselves to such legislation. The clause in the platform regarding electric railways says:

"Recognizing the important and useful part electric transportation at present bears in our county, gridironed by numerous lines and ultimately to have a great population to be accommodated by them, we request our members of the Legislature and State Senator at the next regular session to advocate and vote for some proper and well-grounded law permitting these lines to transport freight."

The attitude of this, one of the strongest Republican counties in the State, on the trolley freight question, declared State Treasurer Mathues, indicates that it will be made the principal issue in the election for Governor and members of the Legislature. Representative Cooper, the oldest member of the Legislature, came out vigorously in the convention for this legislation. He declared that the time had come when the railroads could no longer oppose the granting of rightful powers to the trolley lines and the development of the farming interests of the State.

"I shall vote for this legislation and do all in my power to have the next Legislature enact proper laws along this line," said Mr. Cooper. "A law can be passed which will carefully guard the interests of the whole community and at the same time give trolley lines the authority to transport freight. If necessary, the trolley roads should be given the right of eminent domain, the same as steam roads. * * * Freight trolleys will be accomplished in the next Legislature."

RAILROAD COMMISSION IN OHIO

The Ohio Legislature now in session is very likely to pass the Wertz railroad commission bill, which has been favorably reported before the House. It follows closely the Indiana railroad commission bill, and provides for three Commissioners to be appointed by the Governor, who will have power to regulate railroads and all companies engaged as common carriers, but will have no supervision over rates of electric railroads within the limits of a municipality. They will have power to regulate freight and passenger tariffs, to enforce regulations for furnishing cars, to oversee bridges, terminals, side tracks, crossings and connections with other railroads. The Commission has power to inquire into the management of all railroads, inspect all books and papers in regard to any matter under investigation, and the powers of courts in enforcing its order and making its investigations.

A NEW ELECTRIC BELT ROAD

Advocates of a new electric belt railway to encircle Indianapolis at a radius of 14 miles, held a meeting in Indianapolis recently, and effected an organization, with B. V. Hubbard, president, and T. J. Wright, secretary. It was shown that the proposed line would pass through fifteen towns and connect with eighteen steam and electric railroads. It is proposed that the new belt line shall handle both freight and passenger business. Representatives from the fifteen towns were present, and contended that the road would occasion their respective towns to assume greater importance and become closely linked with the business and manufacturing life of Indianapolis, besides furnishing numerous good sites for manufacturers on the belt.

FROM SEATTLE TO PORTLAND

Articles of incorporation have been filed with the Secretary of State for the Washington Northern Railroad Company, believed to be a Harriman corporation, organized for the purpose of building from Seattle to Portland. Jacob Furth, J. D. Trenholm and F. K. Struve are the incorporators, the capitalization is $500,000, and the principal place of business is located in Seattle. It is made optional for the company to build either an electric or a steam road, running from Kelso, in Cowlitz County, through Lewis, Thurston, Pierce, King and Snohomish Counties to Everett. Authority to own and operate steamboats, tugs, barges, warehouses, telephone and telegraph lines is reserved. Though the articles declare the company seeks permission to build as far as Everett, it is known that the immediate plans do not contemplate work north of Seattle. A connection will be afforded with the Harriman lines at Portland.

LOS ANGELES & SAN DIEGO BEACH COMPANY

Articles of incorporation of the Los Angeles & San Diego Beach Electric Railway Company have been filed for record at Los Angeles. The articles state it is the purpose of the company to construct an electric railway from Los Angeles through Orange County and Santa Ana to San Diego, and also to Tia Juana, with a local system in San Diego. The company is capitalized at $6,000,000, divided into shares of $100 each. Of this amount it is stated that $165,000 has actually been subscribed. The directors for the ensuing year are: E. S. Babcock, A. E. Babcock, R. B. Talbot, A. E. Lillicrap and James Stroub. By many it is believed that Henry E. Huntington is behind the movements of this company; in fact, its principal backer. The new company is already at work on the narrow-gage road between San Diego and La Jolla, which is being standardized with heavy rails and electrified. Heavy cars for use on this road have arrived. It is understood that the Tia Juana and Cuyamaca dummy lines are to be rebuilt and electrified as soon as possible. Furthermore, it is rumored that the La Jolla line is to be extended 40 miles to Oceanside. It is not improbable that the lines of the new company will ultimately connect with the Huntington line now operating between Los Angeles and Santa Ana, which is soon to be extended to Newport Beach, with 15 miles additional trackage down the coast to Laguna.

PHILADELPHIA POWER HOUSE DAMAGED BY FIRE

The power plant of the Philadelphia Rapid Transit Company at Second Street and Wyoming Avenue, Philadelphia, was seriously damaged by fire Friday morning, March 23. It is presumed that the fire, which originated in the frame gashouse adjoining the plant, was the result of spontaneous combustion. The main building destroyed was a 2½-story brick and stone structure, with a corrugated iron roof. Following the fire the announcement was made that the equipment would all be ready for service again by the middle of the week, no very serious loss having been sustained by that portion of the plant.

ANOTHER IMPORTANT LINK TO BE CLOSED

It is announced that the Western Ohio Railway interests have decided to build a line from Fostoria to Fremont, Ohio, and that work will commence this spring. This is one of the most important links uncovered in Ohio. In connection with the Lake Shore Electric, Toledo, Fostoria & Findlay, Western Ohio and Indiana Traction it provides a direct route from Cleveland to Indianapolis only a few miles longer than the most direct steam road. The Toledo, Fostoria & Findlay Railway, operating between Fostoria and Findlay, is preparing practically to rebuild this portion, and it is understood that the Western Ohio has made an arrangement for operating over this stretch with a privilege of buying it. Another significant point about closing this gap is that the Lake Erie & Western Railway (steam), a Vanderbilt property, will be paralleled its full length through Ohio and Indiana.

AN EVERETT-MOORE CONSOLIDATION

The effort of the Everett-Moore syndicate to secure options on the stocks and bonds of the Cleveland, Painesville & Ashtabula Railway is reported to be progressing in a very favorable manner, and it is stated that enough of these securities have been optioned to make almost certain the long-talked-of merger of lines between Cleveland and Erie this year. If perfected, the merger would include the Cleveland, Painesville & Eastern, owned by the Everett-Moore syndicate; the Cleveland, Painesville & Ashtabula, owned by independent Cleveland interests; the Pennsylvania & Ohio, and the Conneaut & Eastern. It is stated that the securities of the last mentioned companies are so closely held that the merger can be effected at almost any time if satisfactory terms are arrived at. The proposed merger has been under consideration for several years, and when the Cleveland, Painesville & Ashtabula Railway was built, its power station at Painesville was designed so that it could furnish all the power necessary for the 100 miles of road between Cleveland and Erie. The merger promotors are of the opinion that a large amount of through business could be secured and the roads were operated as a unit and high-speed service provided for.

SEVERE SNOW STORMS IN OHIO

Monday and Tuesday, March 19 and 20, will long be remembered by the interurban roads of Ohio, as scarcely a line escaped complete or partial tie-up. The majority of the roads were not prepared for the storm, as it was so late in the season that many of them had stored away their snow-plows. The Cleveland roads suffered severely. The Lake Shore Electric maintained its limited service between Cleveland and Toledo, but cars came in late. The southern division of the Cleveland & Southwestern was tied up at intervals during four days, the snow drifting back after it had been cleaned off. Three cars spent the night in the storm. The Chagrin Falls division of the Eastern Ohio was put out of business, and the town was isolated for two days. Nearly all of the Dayton roads suffered severely for two days. The Urbana, Bellefontaine & Northern was tied up for a day and a half. On the Dayton & Troy Electric Railway there was a serious accident, as the result of an attempt to keep the road open. A home-made snow-plow, heavily weighted, which was being pushed by a motor car, collided with a horse that had caught its foot in a cattle guard. The plow was overturned in a ditch, and three men were crushed to death or smothered in the snow. The motorman in charge of the work car, which was pushing the snow-plow, said that it was impossible for him to see any great distance ahead on account of the flying snow.

BROOKLYN ENGINEERS VISIT BROOKLYN SUBWAY

On Saturday, March 24, a large number of members of the Brooklyn Engineers' Club and their friends paid a visit of inspection to the Brooklyn extension of the rapid transit subway. The party was conducted by representatives of sub-contractors Cranford & McNamee, through whose courtesy the club was enabled to observe thoroughly the methods of reinforced concrete and brick-lined tunnel construction used, and spent a very pleasant and profitable afternoon. The section which was viewed extended from a point a little west of Clinton Street, where the steel tube construction running down to and under the East River begins, to DeKalb Avenue and Fulton Street. Interest in the trip was greatly increased by pleasant memories of a previous excursion to this work about a year ago, and some hundred guests enjoyed the opportunity given by the sub-contractors to again visit this important municipal undertaking. Several members of the Society of Municipal Engineers of New York were also entertained on the same afternoon by Messrs. Cranford & McNamee.

A NEW FIRM OF CONSULTING ENGINEERS

John C. Kafer, Asa M. Mattice and Benjamin H. Warren have just formed a partnership as consulting engineers, with headquarters at 60 Wall Street. The firm will act as consulting engineers for steam, hydraulic, gas and electric power plants, also for mills, industrial establishments, water works and mining plants. The three members of the firm are all well known in engineering circles. Mr. Kafer was vice-president and general manager of the old Morgan Iron Works in New York from 1888 to 1900, and for the past four years has been superintendent of the Quintard Iron Works. Mr. Mattice has recently been chief engineer of the Allis-Chalmers Company. Previous to that time he was chief engineer of the Westinghouse Electric & Manufacturing Company, and later of the Westinghouse Machine Company. Mr. Warren for the last five years has been president of the Allis-Chalmers Company, and was previously assistant general manager and afterwards vice-president of the Westinghouse Electric & Manufacturing Company. All three have been connected with the engineering corps of the United States Navy.

AN IMPORTANT CONSOLIDATION

The tendency toward combining like industrial organizations to secure economies in the manufacture and sale of apparatus is again manifested in the formation of the Electric Service Supplies Company. The new organization is composed of three important companies, all of which have introduced some widely used devices, and have also conducted a general electrical supply business. These companies are The Mayer & Englund Company, of Philadelphia; Porter & Berg, of Chicago; the Garton-Daniels Company and the Electrical Devices Company, both of Keokuk, Ia. This consolidation will make it possible to maintain a larger number of warehouses and sales offices throughout the country than would have been possible with the original companies carrying on their business as formerly. Without doubt, these arrangements will also bring about a large saving in shipping, rental and sales department expenses, and make it possible for the new company to serve the railway industry more efficiently than ever. It should be noted that both the sales and manufacturing departments will be continued as in the past and that all correspondence, orders, etc., should be sent to the present headquarters of the constituent companies. As this consolidation is of such wide importance to the industry, it may not be amiss to give a brief sketch of the career and works of the firms making up the new company.

The Mayer & Englund Company, of Philadelphia, is one of the largest concerns in the world devoted to the electric railway supply business exclusively. When the firm was founded in December, 1895, by Chas. J. Mayer and A. H. Englund, it began business by handling the manufactures of the R. D. Nuttall Company and The International Register Company. Shortly afterward the line insulation of the Macallen Company was taken up. At this time the company had two small offices in the Betz Building, but in 1897 a store and basement was secured at 10 South Tenth Street, to which another floor was soon added. The quickly increasing business of the company, however, soon made it necessary for the company to take the entire five-story building. By 1901 even these enlarged quarters proved insufficient, and the company began negotiations for a larger building, then under construction at 1020 to 1024 Filbert Street. The plans were changed to suit the tenant, with the result that to-day the company is the sole ocupant of a splendidly equipped nine-story structure, having a 60-ft. front on Filbert Street and a depth of 80 ft. extending through to Commerce Street. The line of materials handled by this company has grown so extensive that only brief mention can be made here of its specialties. These comprise "Protected" rail-bonds; Nuttall gears, pinions and trolleys; Brady bearings, journal boxes, etc.; International registers; Macallen insulation; Sterling varnishes and paints; Lyon sheet steel gear cases, Packard incandescent lamps, and many others.

The firm of Porter & Berg was organized by J. W. Porter and Max A. Berg, in 1899, to conduct a general electrical supply business, with headquarters in the Manhattan Building, Chicago. In 1902 larger quarters were taken at 305 Dearborn Street, the entire second floor of which serves for the offices of the company, while the warehouses are located at 45 Plymouth Place, directly opposite. Under the new arrangement these offices and warerooms will now handle all of the Mayer & Englund devices besides the products of the two Keokuk companies mentioned in the next paragraph.

To speak of lightning protection, brings to mind immediately the name of the Garton-Daniels Company, of Keokuk, Ia. which has done so much valuable work in the development of lightning apparatus and other protective devices. The company was founded in 1892, and since 1895 has been managed by J. V. E. Titus, whose persistent advertising, combined with the merits of Garton-Daniels products, has been an important factor in the development of this company's business. In 1901 the Electrical Devices Company was formed in Keokuk by the same interests to push the "Automotoneer," a mechanical device for regulating the speed of controller application. It is intended to use the Keokuk plant of these companies for the manufacture of other products handled by the Electric Service Supplies Company.

The new company has been formed with the following officers: President, C. J. Mayer; first vice-president, J. W. Porter; second vice-president, J. V. E. Titus; secretary, Max A. Berg, and treasurer, A. H. Englund. Sales offices will be maintained in Boston, New York, Philadelphia, Pittsburg, Cleveland, Chicago, Atlanta, Birmingham, New Orleans, St. Louis, Keokuk, Kansas City, San Francisco and Los Angeles.

NEW PUBLICATIONS

Electric Railway Accounting: The Monthly Report, the Accounting Department and the Accountant. By W. B. Brockway. New York: McGraw Publishing Company; 84 pages; illustrated. Price, $1.25.

It is somewhat strange, in view of the large number of books which have been published upon the engineering side of electric railroading, that there has been such a dearth of literature available to the general reader upon the accounting side. The success of an electric railway project is judged, by the outside public at least, upon its financial returns, and this success depends quite as much, if not more, upon the judgment with which the initial investment is made and the manner in which the operating accounts are conducted, as it does upon the engineering skill with which the road is installed. It is perfectly safe to affirm that if this truth had been more generally recognized many failures in electric railway enterprises would have been avoided. In fact, there seems to be just as wide, if not a wider, field in electric railway work for the expert consulting accountant as for the consulting electrical and mechanical engineer. Mr. Brockway emphasizes certain points bearing upon this subject in his chapters "The Accounting Department not a Revenue-Producing Department," and "Some Qualifications of the Railway Accountant," and these chapters especially are recommended for study to those to whom accounting is still synonymous with bookkeeping. Taking up the more technical portions of the book under review, Mr. Brockway, as the title indicates, first directs attention to the Monthly Report. In the first two chapters he outlines what such a report should show and then offers a suggested form of report. His third and fourth chapters are devoted to a clear exposition of the units used or proposed in electric railway accounting, viz., percentage of operating expenses to gross receipts, car-mile, car-hour, per passenger carried, per seating capacity, per capita, etc. Each has its place, but no general unit has yet been attained, or is, he thinks, likely to be, although the car-hour is the one "most generally useful." After a consideration of graphical and other statistics and their use, the author takes up "What Standardization of Accounts Means," the "Balance Sheet," "Accrued and Suspended Accounts" and "Expert Examinations," after which follow four chapters on the accounting department and its force. The work, although called by the author in his preface "a brief consideration of the subject," is well worthy a place in the library of every electric railway man, as well as of anyone who is interested in the correct principles of accounting.

STREET RAILWAY PATENTS

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

UNITED STATES PATENTS ISSUED MARCH 20, 1906

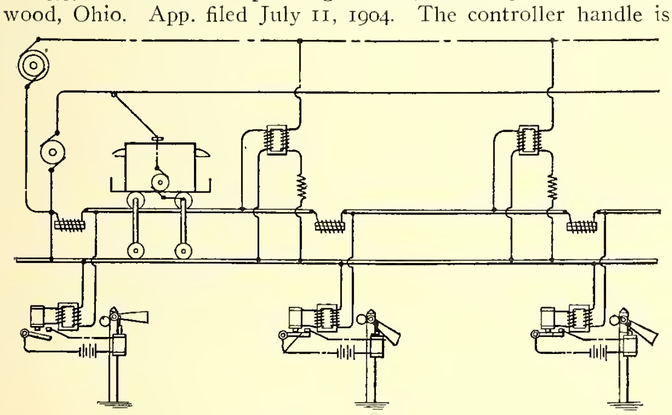
815,380. Rail for Railways and Tramways; Samuel W. Dalzell, Glasgow, Scotland. Provides a removable tread.

815,499. Automatic Overhead Trolley Contact Device for Operating Electric Signals; Beecher D. Whitcomb, Shawomet Beach, R. I. App. filed Nov. 20, 1905. Mounted on the usual trolley hangers is a frame having a compound lever arrangement with a depending tappet in the path of the trolley wheel. The movement is such as to trip a contact lever into operation during the passage of the car.

815,533. Railway Switch Mechanism; Frank K. Hoffman, Dunkirk, N. Y. App. filed Dec. 8, 1905. The switch is normally held closed by spring means and is thrown through suitable connections to a bell-crank lever, one end of which is tripped by the flange of the car wheel.

815,560. Car Switching Mechanism; Harry E. Sharp, Rockville, Conn. App. filed July 19, 1905. Provides an auxiliary flanged ring, under the control of the motorman, which at the desired time may be caused to act upon a fixed frog, by means of which the main car wheels are temporarily controlled and caused to follow the selected track.

815,578. Controller Operating Means; Arthur J. Brown, Norwood, Ohio. App. filed July 11, 1904. The controller handle is



PATENT NO. 815,890

connected to the controller shaft through an intermediate spring connection and a specially arranged detent resists the movement of the controller shaft until after a predetermined movement of the handle has taken place. The shaft then follows the handle with an abrupt movement.

815,666. Stationary Switch and Adjustable Car Wheel for Use Thereon; Alvin T. Winchell, Albion, Mich. Centrally located sliding car wheels mounted on their axle and adapted, when slid inward, to engage the third or auxiliary tread rail or rails.

815,693. Switch; Emanuel Fields, Allegheny, Pa. App. filed Aug. 11, 1905. A crank journaled in a suitable support beneath the switch rail, means for connecting the crank with the rail, a slidably mounted cam plate adapted to be engaged by a car wheel, a rod or pitman pivotally connecting the cam plate and the crank whereby the crank is operated to raise or lower the rail, and means for holding the rail in elevated position.

815,784. Railway Car Truck; Sumner A. Bemis, Springfield, Mass. App. filed Oct. 31, 1903. Details of construction.

815,826. Train Control System; George H. Hill, Schenectady, N. Y. App. filed Aug. 20, 1904. Details of a train control system in which the usual conductors while normally controlled by a pilot circuit, as at present, are rendered inoperative in case there is no current in the motor circuit of that particular car.

815,890. Electric Signaling System; Samuel M. Young, New York, N. Y. App. filed Oct. 18, 1904. A signaling system in which the traffic rails serve as separate and independent return paths for the power and signal currents to the sources of energy.

815,891. Electric Signaling System; Samuel M. Young, New York, N. Y. App. filed Oct. 18, 1904. Details of a block signal system.

815,919. Fender for Motor Cars; Benjamin Lev, Cleveland, Ohio. App. filed July 15, 1904. Consists in a fender having a carrier adapted to be tilted, and thereby bodily and automatically raise the fender mechanism at the front to a detaining elevation when an object of sufficient weight to actuate the same has been struck.

815,920. Separable Fender for Motor Cars; Benjamin Lev, Cleveland, Ohio. App. filed July 15, 1904. The invention consists in a fender in which the several parts are constructed to be conveniently detached and separated and again united.

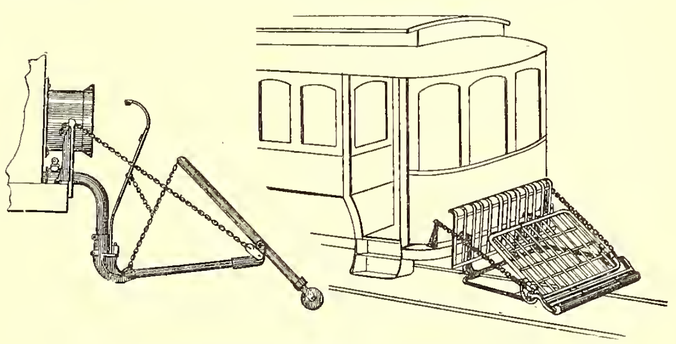
815,921. Spring Buffer for Car Fenders; Benjamin Lev, Cleveland, Ohio. App. filed July 15, 1904. In car fenders, a buffer so constructed to stand across the front of a car, hangers to support the same, and springs supporting the buffer from the hangers.

815,922. Chain Bracket for Car Fenders; Benjamin Lev, Cleveland, Ohio. App. filed July 15, 1904. A bracket having a slot so formed therein as to receive the link of chain edgewise, the next link engaging the shoulders of the slot.

815,923. Detachable Car Fender; Benjamin Lev, Cleveland, Ohio. App. filed Aug. 18, 1905. A hanger for car fenders having a sleeve thereon provided with lugs on its outside and a bracket support hooked upon the lugs from the front.

815,924. Car Fender Spring; Benjamin Lev, Cleveland, Ohio. App. filed July 15, 1904. A spring fender frame constructed to stand across the front of a car and having open mesh fabric at its middle and spring at each side thereof.

815,925. Fender Carrier; Benjamin Lev, Cleveland, Ohio. App. filed July 18, 1904. A knockdown carrier so constructed as to be readily separable into numerous parts whereby when an accident occurs and the carrier is more or less injured it can be readily repaired without being sent back to the factory.



PATENTS NOS. 815,924 AND 815,926

815,926. Automatic Car Fender; Benjamin Lev, Cleveland, Ohio. App. filed July 18, 1904. Means for automatically tilting the roller or tripping member of the fender into a substantially vertical position when the fender carrier is reversed, so as to throw up a front guard across the carrier and protect any one who is picked up by the carrier and prevent their being thrown forward off the same by reaction from the fender-spring or buffer.

815,927. Tubular Car Fender; Benjamin Lev, Cleveland, Ohio. App. filed July 18, 1904. A carrier for car fenders consisting of a channel-iron frame, slats running crosswise of each other and bent at their ends for engagement in said frame, and fastening pieces for the ends engaged with the frame.

815,928. Cushioning Roller for Car Fenders; Benjamin Lev, Cleveland, Ohio. App. filed July 18, 1904. A cushioning roller for car fenders, having substantially cup-shaped heads and tapering collars to engage within the roller-tube and lock the ends of the tube in the heads.

PERSONAL MENTION

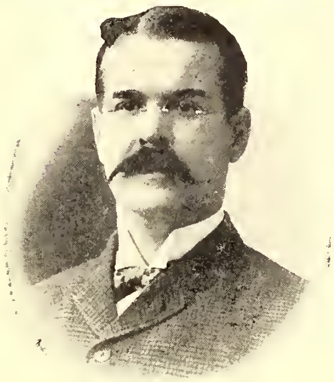
MR. W. TIFFANY, formerly superintendent of the Oregon Water Power & Railway Company, of Portland, Ore., has become connected with the Willamette Valley Traction Company, building a line out of Portland.

MR. L. M. LEVINSON, manager of the Shreveport Traction Company, of Shreveport, La., has just returned from a tour of

Old Mexico, where he spent six weeks examining the street railway, lighting and power field in the Republic, and particularly the matter of electrification of several of the mule lines in the larger cities.

MR. E. E. THORNTON has resigned as superintendent of the Petaluma & Santa Rosa Railway Company, and will be succeeded by Mr. Van Franck, late of the United Railroads, of San Francisco. Mr. Van Franck is the field representative of the new management, which will be directed from San Francisco by the new president, Mr. W. A. Cattell.

MR. PAUL WINSOR, who has just been elected president of the New England Street Railway Club, has had a long and active career in the electric railway industry, and has been prominently identified with many important engineering developments in and around Boston. Upon completing his course at the Massachusetts Institute of Technology, Mr. Winsor entered the employ of the Thomson-Houston Company at its Lynn factory. For eight years he was engaged with a construction company in Pittsburg, and installed a number of electric lighting plants in different parts of the country. He then became associated with the Westinghouse interests, with headquarters at the office at St. Paul, Minn., and had charge of a number of installations in the Northwest. Mr. Winsor then returned to Boston to take up electric railway work with the old West End Street Railway Company. He spent four years with this company, having been advanced to the office of assistant general manager, but in 1896 he resigned to take charge of an electrical supply company in Baltimore. After four years' residence in Baltimore, however, he again returned to Boston to accept the position of electrical engineer of the Boston Elevated Railway Company, his appointment dating from Jan. 1, 1900. In this capacity Mr. Winsor has had especial charge of power house and electrical matters on the Boston Elevated. He has been given more and more responsibility, and last year was appointed to the important position he now holds, that of chief engineer of motive power and rolling stock for the entire system of the Boston Elevated Railway Company. Mr. Winsor has taken great interest in the affairs of the New England Street Railway Club, and the present splendid condition of the club is due in no little measure to his energetic work, counsel and advice. The club is to be congratulated upon having its affairs in so capable hands for the ensuing year.



PAUL WINSOR

MR. GEORGE O. WHEATCROFT, assistant secretary and assistant treasurer of the Milwaukee Electric Railway & Light Company, is dead. Mr. Wheatcroft was one of the pioneer street railway men of Milwaukee, having been connected with the street railways since 1868. He was born in Derbyshire, England, June 14, 1851, and came to Milwaukee when he was eighteen years of age, entering street railway service as a conductor.

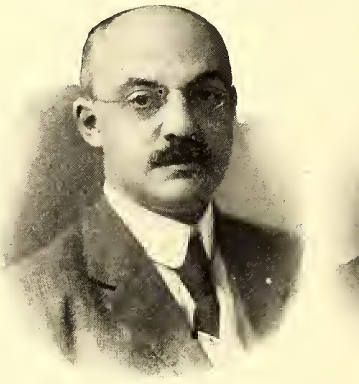
MR. A. W. ANDERSON, of Dayton, for a number of years general superintendent of the Dayton & Xenia Traction Company, of Dayton, Ohio, has resigned and has been succeeded by Mr. Thomas A. Ferneding, heretofore assistant superintendent of the company. Mr. Anderson has been identified with city and interurban roads in that vicinity for more than thirty years. He built and operated several of the Dayton lines, and is considered an authority on all branches of operation and construction.

MR. JAMES PARTRIDGE, manager of the Sandusky plant of the National Carbon Company, of Sandusky, Ohio, is dead. Mr. Partridge, who was fifty-two years of age, was born in Birmingham, England, in 1854. He came to Sandusky from Pittsburg in 1890, and with John Spear organized the Partridge Carbon Company. Through some valuable patents the plant did a thriving business, and in 1899, when it was purchased by the National Carbon Company, Mr. Partridge was retained as manager and had given his attention to the business since. Mr. Partridge is survived by his widow and two sisters.

MR. HARRY H. LLOYD, of Providence, R. I., is to become private secretary to Mr. Robert I. Todd, general manager of the Indianapolis Traction & Terminal Company. Mr. Lloyd was born in Manchester, England, in 1882, but acquired his business education in the local schools in Providence. In July, 1902, he became clerk in the office of Superintendent of Transportation A. E. Potter, of the Rhode Island Company, and three months later he was promoted to the office of General Manager A. T. Potter, where he remained in the capacity of clerk until the coming of Mr. Todd as general manager of the company, March 15, 1903, when he became his secretary. Mr. Lloyd will assume his new duties April 1.

MR. D. H. WILSON, JR., has been appointed electrical engineer of the Erie Railroad, in charge of the power plants and other electrical equipment along the entire system, the appointment being made in recognition of the increasing importance of the electrification work which is being pushed on sections of the system in New York State. Mr. Wilson comes to the road from the American Locomotive Company, and will devote himself at first to the work of equipping the Erie's big power house at Hornellsville. After serving a four years' apprenticeship in the Rogers Locomotive Works at Paterson, N. J., Mr. Wilson studied electrical engineering at the Bliss School in Washington, and then graduated from Purdue University. Before his connection with the American Locomotive Company, Mr. Wilson was on the staff of J. G. White & Company.

IN CONNECTION WITH the organization of the Electric Service Supplies Company, mentioned in this issue, it may be of interest to present some biographical facts of the president and the treasurer of the company. Mr. Charles J. Mayer, who has done so much to make The Mayer & Englund Company a prominent factor in the electric railway field, was associated as early as 1890 with Mr. Robert Nuttall, the founder of the R. D. Nuttall company, and for two years was the general sales agent throughout the country for that company's gears, pinions, trolley bases and other products. In 1891 he entered the Electric Railway Specialty Company, of New York, a company owned by Mr. J. G. White and others, which had the Eastern agency for Nuttall manufactures. In 1893 Mr. Mayer went to Philadelphia, at the time the electrification of the local lines commenced, where he acted as Eastern sales agent for the R. D. Nuttall Company. In the partnership formed with Mr. Englund in 1895 this agency was retained and is still in force. Mr. Mayer became president of The Mayer & Englund Company, Inc., in 1900, and will be president and a director of the Electric Service Supplies Company. Mr. A. H. Englund first entered the electrical field by securing a position in December, 1889, with the Chicago construction department of the old Sprague Electric Railway & Motor Company. His initial work was carried out in Sioux City, Ia. Later he assisted in building the West Side Railway, in Milwaukee, and the Elgin (Ill.) City Railway. When the Sprague Company was absorbed by the Edison General Electric Company, the Western department of the old company organized a railway supply house known as the Electric Merchandise Company, of which Mr. Englund became secretary and treasurer. On Jan. 1, 1892, he left that firm to manage the International Register Company, which he had previously organized, and looked after the affairs of that company until Dec. 1, 1895, when he entered into partnership with Mr. Charles J. Mayer under the title of Mayer & Englund, to conduct a general electric railway supply business, including the Eastern agency of the International Register Company. In 1900, Mr. Englund became the secretary and treasurer of The Mayer & Englund Company, and he will be treasurer and a director of the new company already mentioned.



C. J. MAYER

A. H. ENGLUND

NEWS OF THE WEEK

CONSTRUCTION NOTES

GADSDEN, ALA.—A declaration of incorporation of the Gadsden Railway, Light & Power Company has been filed in the Probate Office by O. R. Hood. The new railway will run from Gadsden to Atlanta south of Alabama City. The purpose of the company is to build and operate a street railway, electric light and gas plant. The company proposes to supply towns, cities and private persons with gas, electric lights and heat. The incorporators are: C. H. Schuler, E. T. Schuler and O. R. Hood. G. H. Schuler is president, and E. T. Schuler, secretary and treasurer.

NEW DECATUR, ALA.—The North Alabama Traction Company will soon commence work on the construction of a car house near the transfer station, about two blocks east of the passenger depot. The company will soon have electric cars running on its new line from Decatur to West Decatur. This line will form a belt, taking in Decatur, New Decatur, East Decatur, West Decatur and South Decatur. The manager of the Payne Theater contemplates erecting a summer theater on the car line on the southern extremity of the city, but the matter has not as yet been fully decided upon.

OAKLAND, CAL.—It is officially announced that the Martinez & Contra Costa Railroad Company, which has filed articles of incorporation at San Francisco, is to take over the franchise granted last February by the Town Trustees of Martinez to M. R. Jones, a local attorney, and is to begin the construction of an electric railway system in that town. The franchise stipulates that work shall be commenced on or before June 13 The official statement is also made that the company intends to extend its line beyond the town limits of Martinez, the first extension to be north to the smelter at Bull's Head point, and the second to the Santa Fe station at Muir. In the future the company expects to connect this line either with the Key Route system or the Oakland Traction Consolidated, thus giving quick connections with Oakland and San Francisco. The new company is incorporated for $10,000. The directors are Purcell Rowe, W. A. Tolchard and Carl A. Johnson, of San Francisco; A. H. Flynn, of this city, and M. R. Jones, of Martinez.

OAKLAND, CAL.—The prospect of a new route and quick service to San Francisco is held out to the residents of Fruitvale by the Ygmacio Valley Railway Company, which has filed articles of incorporation in this city and San Francisco. The new company proposes to tap the district east of Fruitvale and extend its line from the Park Street bridge on the tidal canal in Oakland over to Antioch. A branch line will go through Pine Canyon to Mount Diablo, while a third branch will run through Walnut Creek and Concord to Martinez. The purpose of the road is to give a large section of Alameda County direct service to San Francisco. Work will soon be begun on the road if no great obstacles are thrown in the way with regard to getting a right of way. L. F. Winchell and L. B. Bishop, of San Francisco, are mentioned in connection with the project, but were employed in the preparatory work, and it is said in turn represent others. The company has a capital stock of $2,000,000.

SAN RAFAEL, CAL.—The engineers of the North Shore Railroad have made surveys and estimates of cost for broad gaging and extending the third-rail electric service from Fairfax to Pt. Reges. The construction of a modern hotel and a pier running into Tornales Bay are contemplated by the company.

SACRAMENTO, CAL.—The Central California Traction Company plans, in the near future, to install in Sacramento a complete system of street car lines that will reach every portion of the community. As soon as it secures a franchise along M Street to enter Sacramento the company will probably apply to the municipal authorities for a franchise to run down I Street, and will then branch off in different directions. At a recent meeting of the directors in San Francisco it was decided to issue $1,500,000 of bonds, and the corporation, which has already established some 9 miles of road in the city of Stockton, and has extended its line some 18 miles out in the country to the town of Lodi, will continue on to this city, and will also, it is claimed, run a branch line up through the rich agricultural districts lying contiguous to the Consumnes River.

CENTRALIA, ILL.—The stockholders of the Centralia & Central City Street Railway Company have increased the capital from $10,000 to $100,000, and the name of the company is changed to Centralia & Central City Traction Company. The materials for changing the mule line to a trolley system are now being received.

EAST ST. LOUIS, ILL.—John R. Pierce, of Mount Vernon, Ind., representing the Southern Illinois Electric Railway Company, which has in contemplation the building of an electric railway from Mount Vernon, Ind., to East St. Louis, called upon the city officials last week and showed petitions whereby his company has secured the right of way between the two cities. It is understood that they will arrange to enter East St. Louis over the tracks of the East St. Louis and suburban lines.

ELGIN, ILL.—The Elgin & Bloomingdale Electric Railway Company, which plans to build between Elgin and Bloomingdale, has organized as follows: F. W. Kobusch, Bloomingdale, president; E. W. Fischer, Addison, vice-president; J. H. Roehler, Bloomingdale, secretary; C. F. Strauschild, Addison, treasurer.

INDIANAPOLIS, IND.—The Indianapolis Traction & Terminal Company, as soon as the debris of the wrecked West Washington Street car houses has been cleared, will begin the construction of a new building. As previously stated in the STREET RAILWAY JOURNAL, the car house was wrecked by snow.

KOKOMO, IND.—The equipment of the power house of the Kokomo, Marion & Western Traction Company is to be increased by a 1000-kw Allis-Chalmers turbine-generator unit giving 2300 volts at 60 cycles. The additional power is intended to be utilized for lighting and power purposes and for the extension to be built to Burlington this summer.

MOUNT VERNON, IND.—An election held March 24 in Smith Township, Posey County, to vote aid to the Vanderburg & Posey County Electric Railway resulted in favor of the subsidy. The promoters say this insures the early construction of the line.

NOBLESVILLE, IND.—The City Council has granted a franchise to the Capital City Circuit Traction Company, which proposes to build a line to encircle Indianapolis at a radius of 25 miles. The Council attempted to require the company to light, pave and sprinkle the streets occupied, but the company declined to accept the grant on such terms.

VINCENNES, IND.—The Vincennes Traction & Light Company has filed articles of incorporation with the Secretary of State. The capital stock is placed at $200,000. The declared object of the company is to construct lines of street railroads in Vincennes, Bruceville, Bicknell, Oaktown, Decker and Monroe City, Knox County; Princeton, Gibson County; Washington, Daviess County; Carlisle and Sullivan, Sullivan County; lines of interurban street railroads between said cities and towns, and to supply electricity and steam for light, heat and power in said cities and towns. Benjamin G. Hudnut, Charles A. Gordon, George E. Henry, William Foley and Morris Hudnut are the incorporators. Mr. Henry lives in Vincennes; Mr. Foley, in St. Louis, and the Messrs. Hudnut and Gordon, in Terre Haute.

CLINTON, IA.—The State Electric Company has been succeeded by the Clinton Street Railway Company. The capital stock has been increased to $600,000 paid in, and the bond issue increased to $400,000. Same officers and management are in the new company. This line has been entirely reconstructed and equipped, and this change is made to take care of the expense of reconstruction.

CHANUTE, KAN.—The outlook is said to be very encouraging for the construction of an extensive system of interurban lines in Southeastern Kansas, which will include the cities of Chanute, Erie, St. Paul, South Mound, Parsons, McCune, Mineral, Scammon, Columbus, Galena, Earlton, Thayer, Cherryvale, Independence and Coffeyville, with later an extension to Webb City and Carthage. The name of the company will be the Southeastern Kansas Railway, Light & Power Company. The company is incorporated for $4,000,000, and the incorporators are L. Rosenthal, J. J. Jones, Frank Dixon and R. C. Rawlings, of Chanute, and J. W. Stephens, of New Orleans. The surveying gangs are now working out of Chanute under the supervision of Rawlings and Stephens. The line by way of Erie, Parsons, Columbus and Galena will be built first, and then the extensions from Chanute to Coffeyville and from Galena to Carthage.

NEW IBERIA, LA.—The charter for the Bayou Teche Traction & Power Company, with a capital stock of $1,500,000, has been filed in the office of the District Clerk here. The company is to build a system of electric railways from New Iberia to Berwick, passing through the parishes of St. Martin, St. Mary and Iberia. It is expected that the work of construction will begin within sixty days.

BALTIMORE, MD.—Bids will be received until April 25 by the Washington, Baltimore & Annapolis Electric Railway for approximately 12,000 cu. yds. of concrete masonry, 740,000 ft. B. M. of timber bridging and 21,000 lin. ft. piling. Information may be had at the office of the engineers, the Roberts & Abbott Company, Maryland Trust Building, Baltimore.

ALMONT, MICH.—A bonus of $10,000 is now asked by the promoters of the proposed electric road from Romeo to Almond. A franchise was granted about two years ago and the right of way has been secured. Residents in the vicinity of Almond, it is said, had subscribed $10,000 toward the proposition. Robert Oakman, of Detroit, was at the head of the enterprise.

ALPENA, MICH.—The Common Council has granted a franchise for the construction of an electric railway between this city and Long Lake, a distance of 8 miles. The latter place is rapidly becoming a popular summer resort, and many cottages have been built during the past year. The right of way, it is said, has all been purchased between the two places. Dayton W. Closser and Jackson and Monroe capitalists are interested in the project.

DETROIT, MICH.—Matthew Slush, of this city, who, up to the recent sale of that property to the Detroit United, was president and general manager of the Detroit, Monroe & Toledo Short Line, is considering a proposition to build an important interurban line in Pennsylvania. Mr. Slush has the reputation of being one of the most successful interurban railway builders and operators in the country, and he made both himself and his road famous by his unique methods of advertising. Before his connection with the Detroit, Monroe & Toledo Short Line, Mr. Slush built the line between Detroit and Mt. Clemens, Mich., afterward selling it to the Detroit United.

GRAND RAPIDS, MICH.—A. Walker, of Walkerville, and Dr. G. H. Hale and E. L. Brooks, of Hesperia, are said to be the promoters of an interurban railway between Walkerville and this city, passing through Hesperia, Fremont, Bridgeton, Slocum's Grove and Coopersville. The proposed line would pass through a very rich fruit belt, and would not come in competition with any steam road.

LANSING, MICH.—April 11 is the date set for the meeting of the stockholders of the Lansing & Suburban Traction Company, to be held in this city. It is said that a meeting of the Lansing-Jackson Railway Company will be held soon, at which time it is believed that the matter of merging the properties, which are held by the Elliott-Mills syndicate, into the

United Railways Company, will be taken up. The latter controls the local lines at Kalamazoo and the line between Kalamazoo and Jackson.

RICHLAND, MICH.—William V. Jacobs, of Chicago, has asked the Village Board and the Richmond Township Board for a franchise to construct an electric railway from Kalamazoo to Richland and touch the Grand Rapids-Battle Creek line now being constructed, at Hickory Corners. The road will also touch Gull Lake, Long Lake, Gun Lake and other resort properties.

JAMESTOWN, N. D.—The Jamestown Traction Company has been formed to build an electric railway to Courtenay.

MANCHESTER, N. H.—Plans are said to have been made for building the Manchester, Litchfield & Hudson Electric Railway. The route laid out by the engineers is from the bridge in Goff's Falls, the terminus of the Manchester Street Railway, south to the Litchfield line, thence down the river through Litchfield and Hudson to Hudson Bridge, most of the way on private land. When this line is complete a link will be added that will enable anyone who desires to go from Concord to Boston and to most parts of Eastern Massachusetts and Southeastern New Hampshire by electric railway.

OCEAN CITY, N. J.—The Atlantic City & Ocean City Railroad Company has filed articles of incorporation in Trenton. The company intends, it is said, to construct a road from Somer's Point to a point in the city of Ocean City. The length of the road is to be 1.98 miles. The names of seven directors of the company who are to manage its affairs for the first year are: John A. MacPeak, F. R. Hansell and Joseph F. Cotter, of Philadelphia, and George A. Duval, J. H. Switer, Charles Riceman and George H. B. Martin, of Camden.

RED BANK, N. J.—The Monmouth Traction Company, which operates between Red Bank and Long Branch, has applied for franchises from the Red Bank Commissioners and from the Board of Freeholders. The plan of extension embraces a belt line in Red Bank.

CATSKILL, N. Y.—The Catskill Electric Railway contemplates a 6-mile extension to Cairo this spring. W. T. Seaman is superintendent.

TROY, N. Y.—The Forest Park Railway has unanimously voted to increase the capital stock from $20,000 to $750,000, and the par value of the shares from $25 to $100. This action is taken to place the company in a financial position to submit a good bid for the franchise when it is offered for sale. A hearing is to be given on its application for a franchise on April 4.

AKRON, OHIO.—U. S. Hill and Elmer A. Gault have obtained control of Lakeside Park, on the line of the Northern Ohio Traction & Light Company, south of Akron, and are preparing to install a large number of new attractions. A large dancing pavilion will be erected, new row boats will be placed on the lake and several gasoline launches will be installed; a carousel will be erected, and "fighting the flames," a sensational attraction, will be installed, together with a large number of other improvements. Admission to the park will be free, and it is the aim to make this one of the most popular resorts in this part of the State.

ALLIANCE, OHIO.—The Akron-Alliance Connecting Railroad Company, promoted by A. Keith, and the Alliance, Akron & Cleveland Railroad Company, promoted by Hugh Bleakley, are making a contest for a franchise in Alliance over practically the same streets. The first-mentioned company has a franchise granted four years ago, and there is sentiment that it ought to be repealed to give the otner company a show. The Akron-Alliance Connecting Railroad promoters claim that the project is about to be pushed through. The company offers a straight 3-cent fare in all parts of the city, while the other company offers eight tickets for a quarter.

ALLIANCE, OHIO.—The Alliance, Akron & Cleveland Railway Company has applied for a franchise to enter Alliance. It agrees to give 4-cent fare and sell eight tickets for 25 cents for local passengers.

BUCYRUS, OHIO.—The Columbus, Marion & Bucyrus Railway Company held a meeting at Bucyrus last week, and the stockholders took necessary action to proceed with the construction of the line at once, setting aside $300,000 for the grading and track work. The line will extend from Marion to Bucyrus, and is being promoted by the Webb syndicate, which owns the Columbus, Delaware & Marion Railway. The new line will be an extension of this road, and will be an important link in lines for Cleveland and Toledo from Columbus. James Williams, chief engineer of the Columbus, Delaware & Marion Railway, has opened construction offices in Bucyrus, and construction machinery and material are now being received along the line.

CHARDON, OHIO.—Application has been made to the Secretary of State for the incorporation of the Jefferson & Chardon Railway. The incorporators are: W. H. Wyke, C. D. Shabe, Fred Harrington, Henry Orth, Frank Fortune, L. B. Stanley, Noah Moseley and A. H. Bacon. The capitalization is $100,000, and this will be increased in the near future. The company has secured nearly all the required right of way for a line from Jefferson to Chardon, where connection will be made with the Eastern Ohio Traction Company's line to Cleveland.

CLEVELAND, OHIO.—The Nickel Plate Railroad Company (steam) has arrived at an understanding with the city of Cleveland, and has agreed to spend several millions in grade-crossing elimination in that city. Fifty-four crossings inside the city are to be dispensed with, of which eight will eliminate crossings with the lines of the Cleveland Electric Railway Company.

COLUMBUS, OHIO.—The Columbus, Delaware & Marion Railway Company held its annual meeting last week. This is the holding and operating company of the Columbus, Delaware & Marion Electric Railway Company, the Columbus-Northern Railway, Power & Equipment Company, the Delaware Street Railway Company, the Marion Railway, Light & Power Company and the Columbus, Marion & Bucyrus Railway Company. The following officers were re-elected: John G. Webb, Springfield, president; O. B. Gottschall, Dayton, vice-president; N. J. Catrown, Columbus, secretary, and W. A. Black, Dayton, treasurer. The sum of $300,000 was appropriated to cover a number of betterments, some of which are under way. The improvements include the extension of the line to Bucyrus and the purchase of 31 miles of rails, seven new cars, another 2000-kw turbo-generator for the Stratford power station, the completion of the Richwood-Greencamp spur line, 6 miles, and the beautification of Glenmary Park. Despite the severe competition of three steam roads, the property showed an increase in net earnings of 31 per cent for the year ending March 1.

EAST LIVERPOOL, OHIO.—The Steubenville & East Liverpool Railway & Light Company has filed papers of incorporation with the Secretary of State. Temporary capital stock is $5,000, and the incorporators were Van Horn Ely, Edward McDonnell and others, of East Liverpool. The company was incorporated to build a line from Steubenville to Wellsville, where connection will be made with the Wellsville line of the East Liverpool Traction & Light Company, which is now owned by the Ely syndicate. There is a report that the company may acquire the Steubenville Traction & Light Company's line to Empire, so that it would only be necessary to build from Empire to Wellsville.

ELYRIA, OHIO.—The Lake Shore Electric Railway Company is reported to contemplate extending its Lorain Street Railway further into Elyria and building a belt line to touch a number of large manufacturing establishments which have been built in this place.

MARION, OHIO.—General Manager W. H. Wyke and Treasurer C. D. Shobe, of the Lima & Eastern Interurban Railway Company, are in Marion arranging to start construction work on the new line immediately. T. C. Bowen, of Marion, has been appointed chief engineer, and F. B. Stanley, of Collintown, superintendent of construction. The line will extend from Lima to Marion by way of Kenton, and closely paralleling the Erie Railroad.

MARSEILLES, OHIO.—E. R. Hankey, of Detroit, and G. W. Meeker, of Columbus, president and secretary, respectively, of the Findlay, Forest & Marion Electric Railway Company, held a meeting at Marseilles last week and arranged for right of way through this district. The line will extend from Marion to Findlay by way of Marseilles and Forest, and it is thought that construction work will start this spring.

YOUNGSTOWN, OHIO.—Local people are interested in the Ohio Valley Traction Company, which was incorporated recently, with $50,000, to construct an electric railway through Allegheny, Beaver and New Castle, Pa. The road will bridge two gaps in the chain of electric lines which will soon connect Cleveland and Pittsburg via Youngstown.

YOUNGSTOWN, OHIO.—Property owners of North Avenue and Belmont Park Cemetery have petitioned the Mahoning & Shenango Valley Railway Company to extend its North Avenue line to the cemetery, a distance of 2 miles. Mr. Randall Montgomery, general manager of the company, is considering the proposition.

YOUNGSTOWN, OHIO.—It is stated that Youngstown people are soon to incorporate a new company, with $100,000 capital stock, to be known as the West Side Belt Line Company, with a view of building a belt line from Central Square, in Youngstown, over a number of city streets to the villages of Mineral Ridge, Austinburg and Four-Mile Run. A large hotel, it is said, will be erected near Crume mineral springs at Four-Mile Run. Franchises will be asked for this month, so that the line can be constructed this summer.

ZANESVILLE, OHIO.—The terminals of the Southeastern Ohio Railway, Light & Power Company's new road are Zanesville and Crooksville, 14 miles apart. The company will be ready to operate the last of April or the first part of May. There will be a park on the line 5 miles from Zanesville, on which $30,000 to $40,000 will be spent in improvements by May 15. Wm. H. Neikirk is secretary-treasurer of the company.

WELLSBURG, OHIO.—The Tri-State Traction Company has applied for a franchise to enable it to enter Wellsburg. The company operates between Steubenville and Wheeling.

SALEM, ORE.—The street railway lines of the Citizens' Light & Traction Company are said to have been sold to the Willamette Valley Traction Company, which has in contemplation the construction of an extensive system to extend from Salem into the adjoining country. The company, by the purchase, secures entrance to the city.

PORTLAND, ORE.—Chas. A. Hardy and E. H. Hall have purchased for the Willamette Valley Traction Company the entire plant and holdings of the Cottage Grove Electric Company. The purchasing company will furnish light and power to Cottage Grove, and will shortly install new and better machinery.

BANGOR, PA.—The Monroe & Northampton Street Railway Company has graded about 4 miles of its line. W. H. Kennan is vice-president of the company.

PHILADELPHIA, PA.—Mayor Weaver has signed the ordinance extending the time of completing the Market Street subway for three years from June 1, 1906. The franchises now retained by the Philadelphia Rapid Transit Company are for the construction of a subway under Broad Street, from Walnut Street to the city line; the Frankford Elevated line and the Market Street line. Under a special agreement, the Philadelphia Rapid Transit Company waives all the rights it may possess on Broad Street for fifty years, on condition, however, that the city bind itself during that time not to give a franchise to any other company.

WALLA WALLA, WASH.—The committee on incorporation for the Covello-Wallula Electric Railway is preparing papers of incorporation. The capital stock is to be placed at $3,500,000, and when issued a majority of it is to be held among merchants and business men in Walla Walla, Columbia, Garfield and Asotin Counties. The road is routed to leave Wallula and follow the Walla Walla River to Mill Creek, thence up Mill Creek to Walla Walla. From Walla the line will go through Dixie and Waitsburg, and to Dayton. A branch line will run from Waitsburg through Prescott to Touchet Station.

MILWAUKEE, WIS.—John I. Beggs, president of the Milwaukee Electric Railway & Light Company, who has obtained most of his right of way outside Milwaukee to villages and cities southward and westward free of cost, has given to the people of Watertown concessions in many instances identical with those demanded of the Milwaukee Northern by the Milwaukee Common Council, and on that basis has finally been granted a franchise there. One of the principal provisions incorporated in the Watertown franchise is that Mr. Beggs shall admit over his tracks any other electric line that may wish to enter Watertown.

NEWS NOTES

SAN FRANCISCO, CAL.—A 3-cent-fare ordinance was introduced at a recent meeting of the Board of Supervisors. It is intended to be of special advantage to laboring people going to and returning from their work. The 3-cent rate is to be in effect between 5.30 and 8.30 a. m. and 5 and 7 p. m. The railroad companies will be required to issue these 3-cent tickets in books of twenty tickets each. The ordinance was referred to the judiciary committee, a question having been raised in respect to the railroad companies having the legal right to collect 5-cent fares under its franchises.

SAN FRANCISCO, CAL.—The annual meeting of the stockholders of the United Railroads of San Francisco was held March 15. The following directors of the company were re-elected: Patrick Calhoun, Charles Holbrook, George F. Chapman, B. S. Guinness, J. Henry Meyer, A. C. Kains, I. W. Hellman, Joseph S. Tobin, Thornwell, Mullally, Tirey L. Ford and G. H. Davis. After the meeting was over President Calhoun stated that the report that has gone forth regarding his company having any intention of buying the Oakland Roads was entirely without foundation.

TRENTON, N. J.—The Senate on March 27 passed unanimously the Perkins equal taxation bill as it came from the House. It provides for the assessment of all railroad properties, with the exception of second-class, by the State Board of Assessors, the tax to be paid to the State at the average local rate. The taxation of second-class railroad properties is provided for in the Duffield law of last year.

ALBANY, N. Y.—Assemblyman Wemple's bill, which seeks to break up the practice of "ambulance chasing," was advocated before the Assembly judiciary committee by Robert B. Armstrong, ex-Assistant Secretary of the Treasury and president of the Casualty Company of America. Mr. Armstrong is also the organizer of the alliance against accident frauds, which has been established throughout the country, and which has had bills similar to the Wemple measure passed in Massachusetts, Maryland and other States. Mr. Armstrong said that he wanted a law which would reach the layman "ambulance chaser," who was exempt under existing laws, and to whom is due in large measure the piling up of needless litigation. The existing laws, he said, take care of the lawyer who is guilty of this offense, but do not reach the layman.

ALBANY, N. Y.—The United Traction Company Employees' Benevolent Association has increased its death benefit from $50 to $100. James McCredie, secretary-treasurer of the company, was re-elected president of the association. Besides Mr. McCredie, the following were made directors: Joseph M. Murphy, James M. Sheehan, John Fitzgerald, William B. Handerhan, John J. Coughlin, Joseph Bradley and John McAvoy, representing the Albany division; Frank O'Neill, Moses H. Young and James McKeon, representing the Troy division. The other officers of the association are: Vice-president, Frank O'Neill; secretary, David Caswell, and treasurer, John W. McNamara.

BROOKLYN, N. Y.—The axle of a rear truck of car 101 of a local train on the Brooklyn Bridge snapped Monday morning, April 2, and tied up traffic on the Bridge for three hours. The train was on its way from Brooklyn to Manhattan, and was about 300 ft. from the Brooklyn anchorage. It was 7.40 a. m., and all of the Bridge trains were crowded. The accident tied up all traffic on the Bridge Railroad and drove folks to the trolley cars, which were already crowded when the newcomers attempted to climb aboard. So many got on the trolley cars that the trolley lines became congested, the cars moving slowly for 100 ft., then stopping, then moving anther 100 ft., so that men and women took to the footpaths and wagon roadways, walking to Manhattan.

NEW YORK, N. Y.—The stockholders of the New York, Westchester & Boston Railway Company, at their annual meeting, re-elected practically all the old directors as follows: L. Bull, Marsden J. Perry, Frederick W. Whitridge, Robert E. Robinson, Frederic Bull, R. C. Colman, Andrew Freedman, Charles Pryer, Robert C. Pruyn, William Barclay Parsons, Charles E. Lewis, J. R. McAllister, Evans R. Dick, W. H. Buckley and Oakleigh Thorne.

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company has raised the rating of its elevated station agents, shortened their hours at the busy stations, and the women employees are placed in this branch of its service on the same basis as the men. Up to the present time the elevated agents have been paid 12 cents an hour for the twelve-hour trick. The trick has now been shortened to eight hours and the pay raised to a sliding scale ranging from 12½ cents to 17½ cents an hour. The agents at the elevated stations where the telegraph has been installed are ranked as operators. Their pay of $2.10 a day is not changed by the new bulletin.

DAYTON, OHIO.—The People's Railway Employees' Aid Association, an organization of the employees of the People's Railway Company, held its sixth annual banquet last week. J. L. Breen, general manager of the company, was toastmaster, and made an address on the association's work. Nearly every employee of the company is a member.

WHEELING, W. VA.—The management of the City Railway Company has caused an announcement to be made to the motormen and conductors in its employ that beginning with April 1 they would be paid 22 cents an hour instead of 21 cents, as at present. This makes the rate of wages on the City Railway the same as the prevailing rate on the Wheeling & Elm Grove.

FINANCIAL NOTES

NEW HAVEN, CONN.—The New York, New Haven & Hartford Railroad makes an offer to exchange one share of its capital stock for each $200 value of the 4 per cent debentures of the Consolidated Railways Company issued Jan. 1, 1904, and Jan. 2, 1905. The exchange may be effected between May 1, 1906, and July 1, 1906, accrued interest on the debentures to be exchanged for accrued dividends on the stock. Exchange may be made in New Haven, Boston and New York. The new stock certificates will be issued as soon as practicable after May 1. The outstanding Consolidated Railways debentures affected amount to between $7,000,000 and $8,000,000. The plan does not affect the Consolidated Railways debentures issued for the Berkshire system.

SARATOGA, N. Y.—The Hudson Valley Railway, in process of reorganization without foreclosure, has filed a certificate of increase of capital stock from $3,000,000 to $5,500,000, in order to make provision for the conversion feature of the $2,500,000 new second-income "B" debentures, which after two years are exchangeable, dollar for dollar, for 5 per cent non-cumulative preferred stock, at option of holder.

AMONG THE MANUFACTURERS

CHARLES J. GOLDMARK, consulting electrical and mechanical engineer, announces his removal to 7 West Thirty-Eighth Street, New York.

THE WILKESBARRE & HAZLETON RAILWAY, of Wilkesbarre, Pa., has ordered two turbine-type Westinghouse generators of 1000-kw capacity, three-phase, 25-cycles, to operate at an e. m. f. of 300 volts.

A FEEDER WIRE SPLICER for solid or standard copper wire has been designed recently by the Ohio Brass Company, of Mansfield, Ohio, and is described in detail in a new pamphlet just published by the manufacturer.

THE ROBINS CONVEYING BELT COMPANY, of New York, has issued a series of printed sheets, each descriptive of some special phase of conveying work. These include contractors' conveyors, coal conveyors, trippers, hoisting towers, etc.

H. B. UNDERWOOD & COMPANY, the well-known Philadelphia manufacturers of portable tools for railway shops, are sending out to their friends complimentary copies of Fred. H. Colvin's valuable treatise on "Link Motions, Valves and Valve Setting."

ELECTRIC RAILWAY COMPANIES anxious to secure additional power equipment immediately for handling their coming summer traffic will find a very interesting list of a large variety of railway generators and motors in a booklet just issued by Joseph H. Thompson, Jr., of New York.

THE GENERAL VEHICLE COMPANY, of Long Island City, N. Y., has succeeded to the business of the Vehicle Equipment Company, and advises that the manufacture of power vehicles will be continued under conditions which will insure the highest standard of excellence, and embrace all classes of commercial automobiles.

THE BRILL NOISELESS BRAKE HANGER, which was described in the STREET RAILWAY JOURNAL of Feb. 3, 1906, now has a complete publication devoted to it in the form of a neat descriptive pamphlet explaining, with the aid of several excellent views, the merits of the J. G. Brill Company's latest improvement in rolling-stock apparatus.

THE BAYONET TROLLEY HARP COMPANY, of Springfield, Ohio, has just published a compact booklet describing the two specialties which have been favorably received by electric railway companies—the Bayonet detachable trolley harp and the Butterfly sleet cutter. A new rope hook made by this company is also described in this publication.

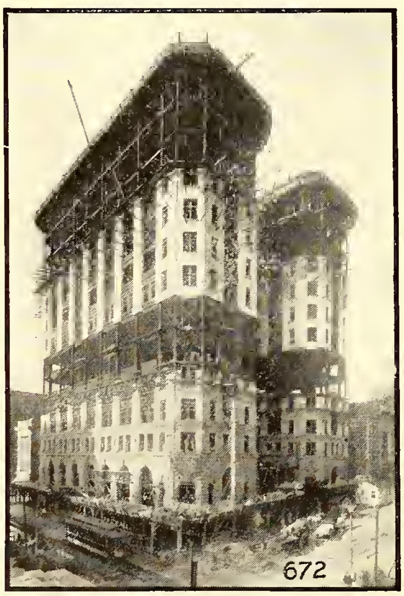
AT THE RECENT ANNUAL MEETING of the Wellman-Seaver-Morgan Company, of Cleveland, Ohio, the office of general manager, which has been vacant since the death last June of Charles H. Wellman, was filled by the election of S. H. Pitkin, whose present title will be vice-president and general manager. Otherwise, no changes were made in the officers of the company.

THE STANLEY-G. I. Electric Manufacturing Company, of Pittsfield, Mass., has published a bulletin, No. 601, on direct-current motors and generators ranging from 1/8 hp to 15 hp. Details are also given of auxiliary apparatus in connection therewith, such as rheostats and switchboards. A valuable feature of this publication is the discussion on belts and pulleys, with methods of calculating the power transmitted.

AN INTERESTING BOOKLET has lately been distributed by W. N. Matthews & Brother, of St. Louis, in which are described the improvements recently incorporated in the well-known Stombaugh guy anchors. In connection with this, there is included the report of a test of the holding capacity of this anchor, conducted by Professor R. C. Carpenter, of Cornell University, as well as an illustrated description of the Kearney cable clamp.

THE MARINE ENGINE & MACHINE COMPANY, of New York, has outgrown its present quarters, owing to the recent increase in its elevator business. The company has therefore taken possession of a new building at 230-232 West Thirteenth Street, New York, and will occupy it as the headquarters of its elevator construction department. This does not interfere with the company's downtown office headquarters, which will still be maintained at 126 Liberty Street.

THROUGH AN UNFORTUNATE OVERSIGHT IN PRINTING the March 31 issue of the STREET RAILWAY JOURNAL, one of the cuts on page 505 was reproduced upside down. This was an illustration of the new electric heater with junction box attached, made by the Consolidated Car Heating Company, of New York. Attention is called to the matter at this time that no confusion may arise as to the actual appearance of this heater, which is made for cross-seat installation.



A BOOK ON VOLTAX, the remarkable insulating material made by the Electric Cable Company, of Bridgeport, Conn., is now being distributed by the manufacturer. The contents are printed in large, clear type on heavy paper, bound in neat and durable boards. The text embraces a detailed description of this insulating compound and of the severe, but successful, tests made on it by the Electric Testing Laboratories, of New York. The design and printing of this book was carried out by Bruce & Banning, of New York.

EQUIPMENT NOTES

H. P. HILL, formerly in charge of the St. Louis office for Allis-Chalmers Company, has been appointed district sales manager for the Weber Steel-Concrete Chimney Company, New York, with offices at 507 Singer Building, succeeding H. R. Hyatt. The business of the Weber Steel-Concrete Chimney Company in March was the largest month's business in the history of the company, and prospects are good for still better business as the season advances.

THE GARTON-DANIELS COMPANY, of Keokuk, Ia., has just published bulletin No. 51, which reveals the progress made recently by this company in the manufacture of direct-current lightning arresters. A detailed description is given of the latest type of Garton-Daniels arrester for railway service. The principal features of this arrester were first described by J. V. E. Titus, president of this company, at the January meeting of the Central Electric Railway Association, of which a complete report was published in the STREET RAILWAY JOURNAL of Feb. 3.

THE WESTINGHOUSE COMPANIES' PUBLISHING DEPARTMENT is sending out a neatly printed booklet entitled "Air Brakes for Electric Cars," the same being a reprint of a paper prepared by W. S. Bartholomew, of the Westinghouse Air-Brake Company, which paper was presented at the Nov. 23, 1905, meeting of the New England Street Railway Club, and abstracted in the STREET RAILWAY JOURNAL of Dec. 9, 1906. The diagrams showing the layout of Westinghouse air brakes for surface trailers will be found especially valuable to street railway men.

THE SMITH IMPROVED LOCK-NUT COMPANY, of Rockford, Ill., has prospered since it started its factory, less than five months ago. This is evidenced by the fact that the capital stock of the company has recently been increased from $20,000 to $30,000. The capacity of the factory, which was 2000 lock nuts per day at the start, has had to be increased to 10,000 per day, and inside of sixty days the company expects to be turning out from 25,000 to 40,000 per day. The company has as customers about seventy-five steam and electric railways, but the electric railways are in the majority.

SOME FURTHER ADAPTATIONS of the inter-pole motor for machine-tool work are shown in circular No. 25, which the Electro-Dynamic Company, of New York, has just published. The inter-pole motor is made either open, semi-enclosed, with screen covers, or fully enclosed, and in horizontal, vertical, elevator and hoist types. This company makes a specialty of large horse-powers and wide speed variations. Ratios as high as 6 to 1 are regularly listed, and the inter-pole motor may be furnished as high as 150 hp in either constant or variable speed, and in any of the types mentioned.

IN ORDER TO HANDLE BETTER its rapidly increasing business from the Rocky Mountain District, the Power & Mining Machinery Company, Milwaukee, Wis., has opened an office at 312 Seventeenth Street, Denver, Col. This is in charge of Henry F. Jurs as district manager, who will give attention to all inquiries coming from Colorado, Wyoming and New Mexico for the varied lines of machinery manufactured by this company. Mr. Jurs' practical knowledge of the business, together with the reputation of the company he represents, will prove a strong factor in securing his share of the business from the territory mentioned.

CONSOLIDATION OF WESTINGHOUSE AND FINZI INTERESTS IN ITALY.—On March 1 a contract was signed between the Societa Anonima Officine Elettro-Ferroviarie, of Milan, with a capital stock of 1,500,000 lire, manufacturers of rolling stock and electrical material, and of the Société Anonyme Westinghouse, of Paris, with a capital stock of f. 25,000,000, by which plants will be installed in Italy by the two companies in harmony. Single-phase installations will be made under the name Westinghouse-Finzi, and will be constructed under patents owned by both the Westinghouse Company and Dr. Geo. Finzi, who is the general manager of the Officine Elettro-Ferroviarie.

STEAM TURBINE IN SIAM.—The General Electric Company has received an order from the Siam Electricity Company, of Bankok, for a 500-kw Curtis steam turbo-generator unit. The fuel used is paddy husks, which are brought down the river from the rice fields in flat-bottomed boats to the power house. They are unloaded directly into the boiler room by an elevator and belt conveyor built by the Link Belt Engineering Company, and operated by several direct-current, 500-volt-General Electric Company motors of the CE type. This method of using rice husks for fuel is an economic utilization of a waste produce similar to the use of the crushed sugar cane, or bagasse, on sugar plantations.

THE BARNEY & SMITH COMPANY, of Dayton, Ohio, proposes to reincorporate and increase its capital. The new company, which is to be incorporated under the laws of West Virginia or Ohio, will issue, it is said, $2,000,000 of 5 per cent bonds, half to be used to retire the existing 6 per cent bonds, and the balance as required for improvements and extensions. In addition to the $2,500,000 8 per cent preferred stock and $1,000,000 common stock issued by the existing company, $2,000,000 common stock will be put out, and will be paid to the preferred stockholders in lieu of 36 per cent of deferred dividends. The reincorporated company will thus have a capitalization of $7,500,000 as follows: $2,000,000 5 per cent bonds, $2,500,000 8 per cent preferred stock, $3,000,000 common stock.

CHARLES F. JOHNSON, of Buffalo and Cleveland, comes to the front again with another lot of sixty-three brand new St. Louis twelve-bench open cars. He says that he is offering them at a price of about one-half of what they cost, although they have not had three months' service, and the paint is not even scratched. He has thirteen-bench, twelve-bench and eleven-bench, both single and double-truck, in the lot, to carry eighty to ninety people. They are the latest style and finest construction that the St. Louis Car Company can build, with double angle iron channel sills, iron bumpers, wide monitor roofs, with bird's-eye maple ceiling, long platforms, reversible seats, 7 ft. 7 ins. wide over the sills, and from 33 ft. to 35 ft. over all. He states this is a rare chance to buy cars, actually new, at sacrifice price.

AMONG THE ORDERS for the Thomas soldered rail-bond recently received by the Lord Electric Company are the following: Indianapolis & Western Traction Company, Indianapolis & Eastern Traction Company, Indiana Union Traction Company, Twin City Rapid Transit Company, Keystone Construction Company, Essex, Ont., Canada; Tuscarawas Traction Company, New Philadelphia, Ohio; New Orleans Railway & Light Company; Louisville & Southern Indiana Traction Company, and two orders for bonds through commission houses to be installed in Mexico. The excellent work performed by this company in the installation of its soldered rail-bond, and the satisfactory service given by these bonds in all parts of the country, are factors which promise to give this company an unusually successful business season during the construction period of 1906.

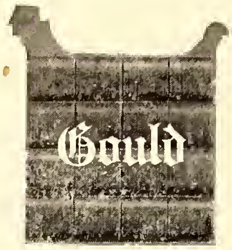
THE KOKOMO, MARION & WESTERN TRACTION COMPANY, whose main offices and power house are located at Kokomo, Ind., on the completion of the additions to its present power house now under way, will install a 1000-kw Allis-Chalmers turbine-generator unit, built by the Allis-Chalmers Company, Milwaukee. The turbine will be constructed at the company's West Allis (Milwaukee) shops, while the turbo-generator to be driven by it will be built at the company's "Bullock" works, Cincinnati, Ohio. The new unit will generate a current at 60 cycles, two phase, of 2300 volts. Other electrical machinery, consisting of a 30-kw direct-connected engine type exciter set, a 35-kw "Bullock" motor generator set, together with switchboard, condensers and piping, will also be furnished by the Allis-Chalmers Company. The power derived from the new unit will be utilized for lighting and power purposes.

THE VAN DORN & DUTTON COMPANY, of Cleveland, is erecting a two-story addition, 60 ft. x 150 ft. A portion of the new building will be occupied by the Van Dorn-Elliott Electric Company, which is affiliated with the other company. The Van Dorn & Dutton Company will install a number of automatic gear cutters and other machinery for increasing its output of gears for railway and other purposes. The Van Dorn-Elliott Electric Company will also install considerable new machinery, as it is going into the manufacture of electric drills for structural iron work, shipbuilding work, etc., outfits which are designed to take the place of pneumatic drills in shops of all kinds. It is also bringing out an electric track-drilling outfit for drilling bond holes. The outfit will be very light, weighing about 60 lbs., including the motor, so that it can be operated and lifted from the track by one man. The feed and control are automatic, and it is claimed it will drill holes through standard rails in 30 seconds.

"COMPRESSED AIR" announces that with its issue of May it will appear in enlarged form and under new management. Hereafter it will be published by the Kobbe Company, 90-92 West Broadway, New York. For ten years "Compressed Air" has been, and still is, the only publication devoted exclusively and covering completely the field of compressed air in all its applications. This field, however, has broadened so materially within the last few years that a more comprehensive periodical is needed to fully meet the new conditions. With the May number, therefore, the size of "Compressed Air" will be changed to 7 ins. x 10 ins.; it will be printed on better paper, and in outward form will be on a par with the best-printed magazines now published. W. L. Saunders, M. Am. Soc. C. E., will remain as editor-in-chief; W. R. Hulbert, M. E., will be managing editor, and P. F. Kobbe, Jr., will be business manager. All subscriptions and correspondence in future should be addressed to the Kobbe Company, 90-92 West Broadway, New York.

A LARGE PIPE-COVERING CONTRACT.—The H. W. Johns-Manville Company, through its Chicago branch, has just completed a large contract for the installation of "Fire Felt" pipe and boiler covering in the new plant of Sears, Roebuck & Company, of Chicago, involving an expenditure of several thousand dollars. In "Fire Felt" the manufacturers have reached the highest degree of efficiency in pipe covering. This covering is absolutely fireproof, elastic, light in weight and unaffected by expansion or contraction of pipes. The above is but one of many large contracts that this company has recently executed, all of which bears testimony to the fact that the largest and most exacting firms have found it to their advantage to place work of this kind under the supervision of experts, and that there is no company better equipped for undertaking work of this magnitude. In addition to being extensive manufacturers of asbestos coverings, packings and roofing specialties, the H. W. Johns-Manville Company is one of the largest manufacturers of electrical supplies. It has branches in all large cities.

AS ALREADY NOTED in the Street Railway Journal, the Magann Air-Brake Company, Ltd., was incorporated under the laws of the Province of Ontario, and last year acquired all the properties, patents, assets, etc., of the G. P. Magann Air-Brake Company. The officers of the company are: Noel Marshall, president, and R. P. Ormsby, secretary. The company is backed by men who can supply whatever capital may be necessary for the development of its business. Attached is a list of the railway companies on whose cars this storage air brake has been installed: Detroit United Railway, Rapid Railway system, Detroit; Detroit & Pontiac Railway Company, Detroit & Northwestern Railway, Detroit, Rochester, Romeo & Lake Orion Railway; Schenectady Railway Company; Grand Rapids, Holland & Chicago Railway; Detroit, Monroe & Toledo Short Line Railway; Detroit, Wyandotte & Trenton Railway; Kansas City & Leavenworth Railway Company; Sandusky & Interurban Electric Railway Company; Redlands Street Railway; San Bernardino Valley Traction Company; Christchurch Tramways Company, of New Zealand; Toronto Railway Company, and the Toronto & York Radial Railway Company.



Absorbs all violent Load-Fluctuations

In present day storage battery practise, the generator carries the average load and the battery, "floated" across the line or connected through a booster, charges when the current-demand is light and discharges when it is heavy. Thus it takes care of all fluctuations above or below the average.

Write for our bulletins describing recent Gould installations for equalizing station loads and maintaining line pressures. Copies free.

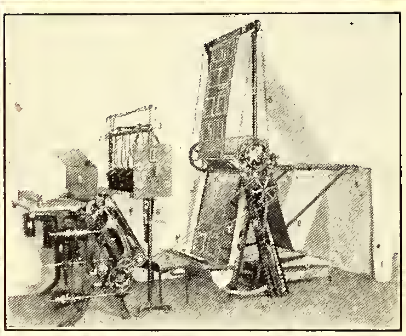
SALES OFFICES:
Boston: 89 State Street
Chicago: Rookery Bldg.
San Francisco: Crossley Bldg.

Gould Storage Battery Co.

MAIN OFFICE:
1 West 34th Street
New York City
WORKS: Depew, N. Y.

THE FRANKLIN

Blue Printer, Washer and Drier



MAKES continuous prints of any length; washes, dries and rolls up the finished print, or will handle separate prints. We supply the Printer, and the Washer and Drier separate or combined as desired.

With the Franklin Blue Printer, prints can be made day or night, 5000 square feet per day, results always uniform. Send for circular.

Williams, Brown & Earle
Dept. 20, 918 Chestnut St.
PHILADELPHIA, PA.

Pantasote

The National Standard for Car Curtains and Seats

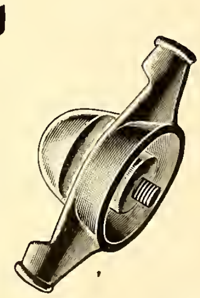
CAUTION

There are worthless and dangerous imitations. Most of them have inflammable surface compounds. Test them with a lighted match to find the genuine. The surface of PANTASOTE will not burn.

THE...
Pantasote
Co., 11 Broadway, New York

Overhead Line Material

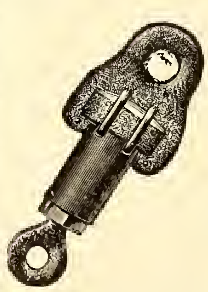
Is our Specialty



Brass Founders.

High Potential Insulation

Write for Catalogue



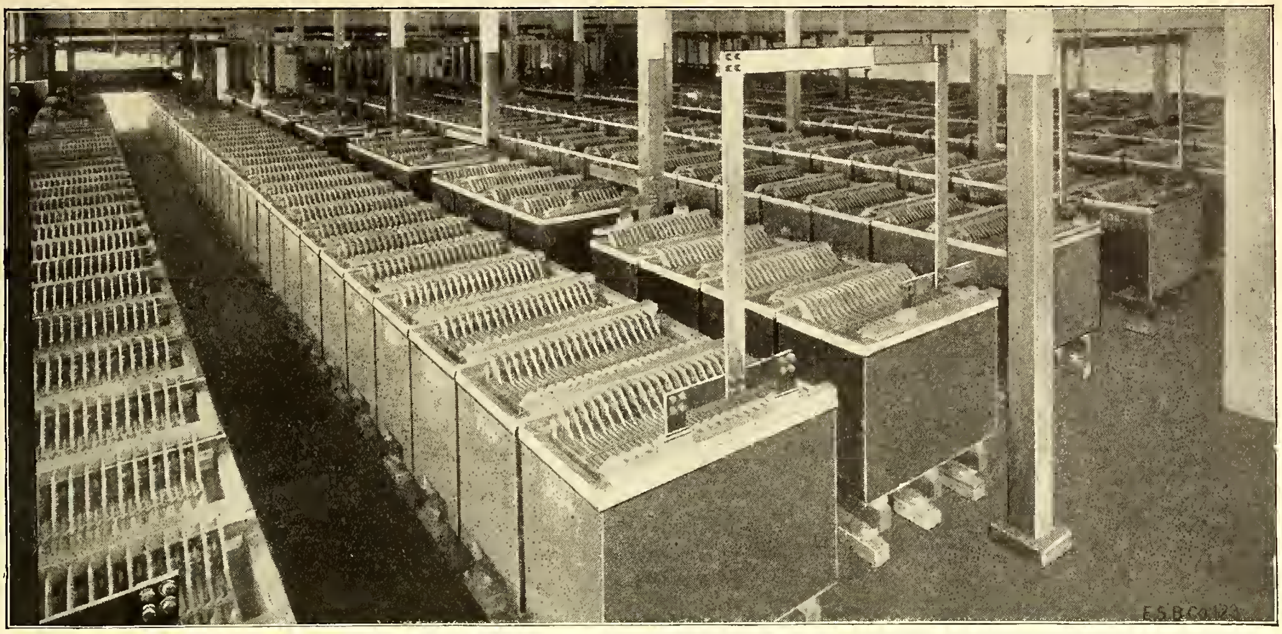
The MACALLEN COMPANY

Formerly The W. T. C. Macallen Company

338 Congress St., Boston, Mass.

THE MAYER & ENGLUND CO., Philadelphia, Pa.
OTTO NEISSER . . . . . Los Angeles, Cal.
FRANK RIDLON CO. . . . . Boston, Mass.
F. BISSELL COMPANY . . Toledo, Ohio
JAS. CLARK Jr. & CO., . . . Louisville, Ky.

THE "Chloride Accumulator" IN ELECTRIC RAILWAY SERVICE



Installation of "Chloride Accumulators" for the Columbus Railway and Lighting Co., Columbus, O. Battery consists of 320 cells, having a capacity of 1,600 Amperes for one hour, and is used in two series on the Lighting Circuit and one series on the Railway Circuit.

THE ELECTRIC STORAGE BATTERY CO.

PHILADELPHIA

SALES OFFICES

PHILADELPHIA, Allegheny Ave. and 19th St. — NEW YORK, 100 Broadway — BOSTON, 60 State St. — CHICAGO, Marquette Bldg. — ST LOUIS, Wainwright Bldg. — CLEVELAND, Citizens' Bldg. — SAN FRANCISCO, Rialto Bldg.

CANADA: Canadian General Electric Co., Ltd., Toronto — MEXICO: Charles L. Seeger, Primera de Humboldt No. 10, Mexico City

CUBA: G. F. Greenwood, Mgr., 34 Empedrado Street, Havana

"Unit Accumulator"

PATENTED JAN. 11, 1905

RELIABLE

FOR STREET RAILWAY WORK

Branch Offices:

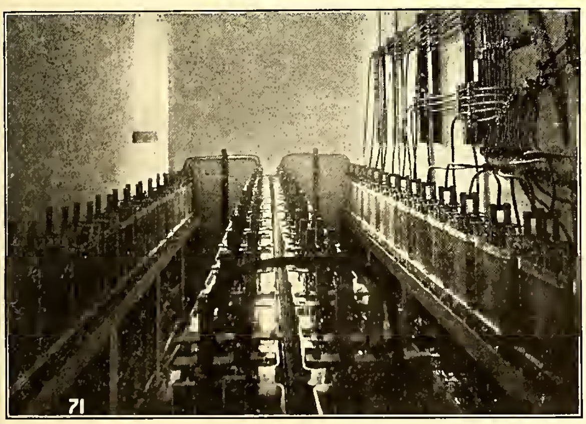
NEW YORK CHICAGO

ASK FOR CATALOGUE, AND BULLETIN ON "A WATER POWER SYSTEM."

National Battery Company

ELECTRIC STORAGE BATTERIES

BUFFALO, NEW YORK



BIJUR "HIGH-DUTY" BATTERIES

Installed at the St. Urban, 89th and C. P. W., New York

Result IN LOWEST OPERATING COST. CLOSEST REGULATION. ECONOMICAL MAINTENANCE

DON'T BUCKLE

GENERAL STORAGE BATTERY CO.

Works: Boonton, N. J. General Offices: 42 Broadway, New York

Railroad and Tram Car Specialties

New Inventions developed, perfected and worked for the English Market

Messrs. G. D. PETERS & CO.,

Moorgate Works Moorfields, LONDON, E. C.

E. G. LONG

95 and 97 Liberty Street, New York

ELECTRIC TRACTION EQUIPMENT AND SUPPLIES

SPECIAL ATTENTION GIVEN TO EXPORT TRADE

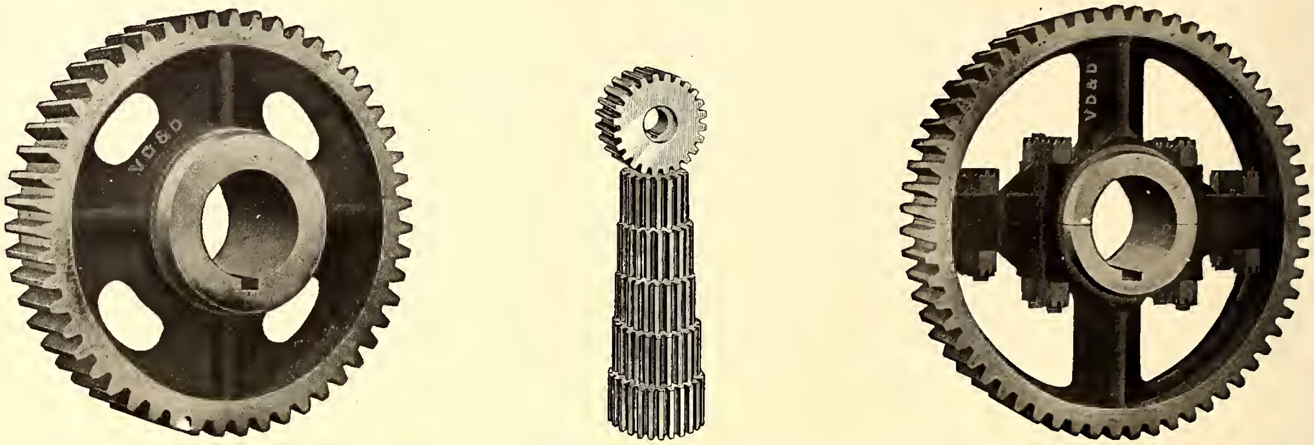
INQUIRIES INVITED

GEARS AND PINIONS

It is no exaggeration when we say our Gears and Pinions have no superior, both in QUALITY and DURABILITY. We cannot say however, that they are the cheapest, as we have not sacrificed QUALITY and DURABILITY to meet low prices.

We use the best Open-Hearth Steel for Gears; best Hammered Steel, high in carbon, for Pinions.

GEARS and PINIONS all perfect in design and construction.



ALL TYPES of MOTOR GEARS and PINIONS CARRIED IN STOCK. WRITE US FOR PRICES

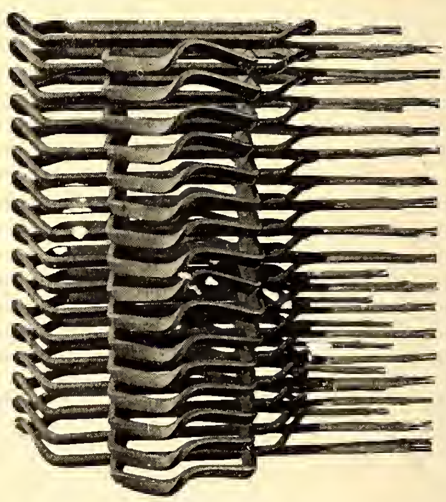
THE VAN DORN & DUTTON CO., CLEVELAND OHIO

Armature Coils *and* Field Coils

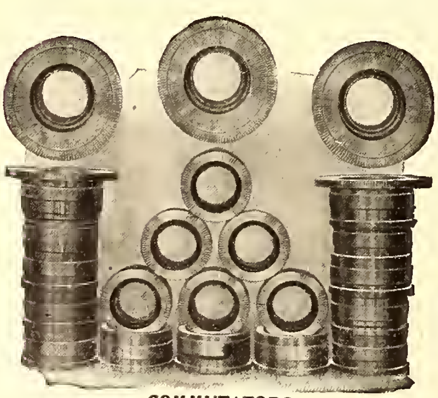
EXACT DUPLICATES OF THE FACTORY COILS

OUR COILS ARE PERFECT in every respect and guaranteed equal to the best factory coils.

OUR ARMATURE REWINDING AND REPAIR DEPARTMENT is equipped to handle the heaviest machinery; all repair work receives prompt attention



ARMATURE COILS



COMMUTATORS
NEW—RE-FILLED—ASSEMBLED

ARMATURE COILS of every type carried in stock.

COMMUTATORS All made of the best Hard Drawn Copper and Soft Amber Mica. We can furnish any size or type on short notice. Our prices will interest you, write us.

☞ **All Coils and Commutators shipped subject to approval.**

The VAN DORN-ELLIOTT ELECTRIC CO.

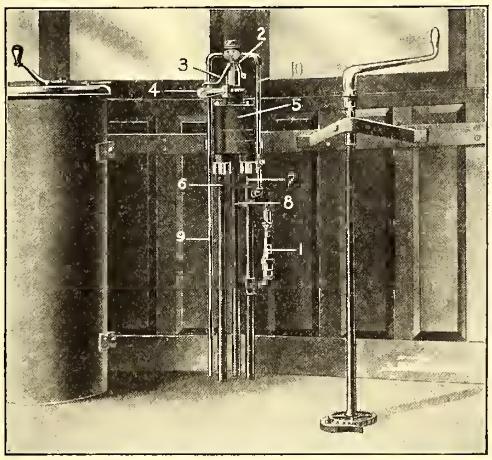
CLEVELAND, OHIO

Aikman Pressure Annunciator

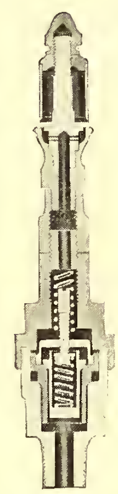
A POSITIVE SAFEGUARD AGAINST ACCIDENTS DUE TO FAILURE of AIR PRESSURE on ELECTRIC RAILWAY AIR BRAKE EQUIPMENTS

PATENT APPLIED FOR

ANNUNCIATOR COMPLETE



1—Aikman Pressure Annunciator. 2—Nichols-Lintern Air Sander Valve. 3—Supplementary Handle for Sander Valve. 4—Handle for Engineer's Valve. 5—Engineer's Brake Valve. 6—Train Pipe Line. 7—Storage Pipe Line. 8—Exhaust Pipe Line. 9—Pipe Line to Sand Trap. 10—Air Supply to Sander Valve.



SECTIONAL VIEW

LOW PRESSURE ALARM

When the air pressure drops below the low pressure point at which the mechanism will operate efficiently, the Annunciator blows a continuous whistle for fifteen seconds, in order to call the motorman's attention to the fact.

HIGH PRESSURE ALARM

When the air pressure exceeds the high pressure point the whistle sounds continuously until the excessive air pressure is reduced to the normal high pressure point.

OPERATES AS A RELIEF VALVE

It will discharge to the atmosphere the capacity of the compressor, should it become short-circuited, or the operator be unable to stop it.

INSTALLATION

It can be quickly and easily installed on storage pipe line below brake valve at a cost too low for consideration and there is

ABSOLUTELY NO MAINTENANCE EXPENSE

Descriptive Circular No. "30" Mailed on Request

THE OHIO BRASS COMPANY

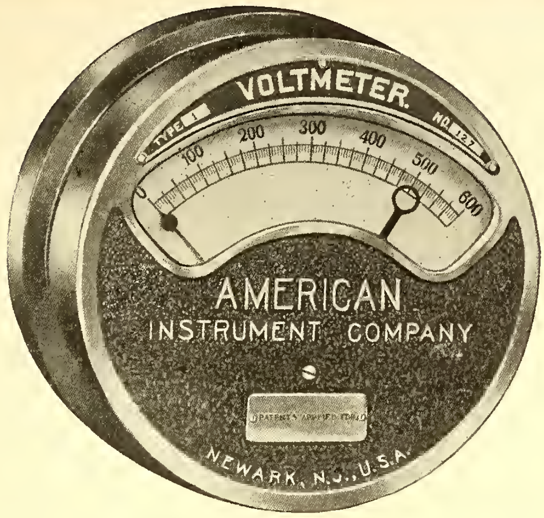
Main Office MANSFIELD, OHIO, U. S. A. Works

321 Dearborn Street, Chicago——BRANCH OFFICES——136 Liberty Street, New York

SALES AGENCIES IN THE PRINCIPAL CITIES OF THE WORLD

American Instrument Co.

James G. Biddle, President **A. O. Benecke, Chief Engineer**



We announce ourselves a new company, with new machine and tool equipment, new ideas and new designs.

We have no old machinery, no old patterns and no old stock which must be sold.

The men who are responsible for our existence have had rare and long experience in the design, manufacture and sale of highest grade ELECTRICAL MEASURING INSTRUMENTS.

They bring to the new enterprise unbounded confidence in their ability to produce and market a full line of COMMERCIAL VOLTMETERS and AMMETERS (both Portable and Switchboard) that will appeal to Engineers and to discriminating buyers.

This week we illustrate our new MODEL 1 ROUND TYPE PERMANENT MAGNET DIRECT CURRENT SWITCHBOARD INSTRUMENT.

As compared with the best instruments of the same general character heretofore obtainable, our MODEL 1 will be found positively dust-proof, unaffected by transportation jolts, free from "sticking" of the pointer, and to possess guaranteed accuracy under practical working conditions as well as when in the makers laboratory.

All who specify, buy or use switchboard instruments *of highest quality* should write at once for DESCRIPTIVE BULLETIN No. 50; and at the same time state requirements as definitely as possible.

Address correspondence to—

James G. Biddle

General Sales Agent

1114 Chestnut Street Philadelphia, U. S. A.

Index to Advertisers

An asterisk (*) indicates advertisements appearing only in the International Edition.

INDEX TO ADVERTISERS—Continued.

EDWARDS WINDOWS

WINDOW FIXTURES
SHADE ROLLERS
SASH BALANCES

— TRADE —
"PAOWNYC"
— MARK —

AUTOMATIC PLATFORM

TRAP DOORS

FOR BLUE PRINTS AND INFORMATION ADDRESS

The O. M. EDWARDS Co.
Syracuse, N.Y.

ROLLER
Direct Reading Bond Tester

The bond tester shown in plan view above is the lightest, smallest, most accurate and quickest reading instrument of the kind on the market. It can be used by a single observer, has a scale several times as long as that of any ordinary voltmeter or ammeter, and shows instantaneously whether the bond resistance is above or below any selected value. A contact bar and set of cords are supplied with each instrument.

Workmanship and Materials are the best procurable

LIST PRICE, $80.00 **Send for Bulletin**

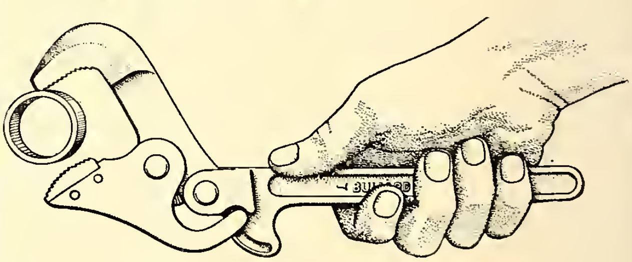
WHITNEY ELECTRICAL INSTRUMENT CO.
MACHADO & ROLLER, General Sales Agents
203 BROADWAY, New York, N. Y.

Vacuum Drying *and* Impregnating Apparatus

EMIL PASSBURG SYSTEM
FOR
Field and Armature Coils
Perfect Drying and Insulation.

JOSEPH P. DEVINE
314 Mooney-Brisbane Bldg., Buffalo, N. Y.
OVER 800 APPARATUSES IN USE

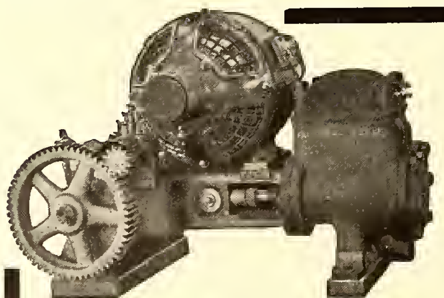
THE BULLARD AUTOMATIC WRENCH



Should be in your Repair Shops, Car Barns and Power Houses, because it is constructed scientifically. Its principle is that of the human hand, TORTIONAL and TWISTING, **NOT** Crushing. It can be adjusted and operated with *one hand.* Its leverage is greater and grip stronger than that of any other wrench.

The Bullard "Wrench Book" will tell you all about it.

The Bullard Automatic Wrench Co.
Incorporated
Providence, R. I.



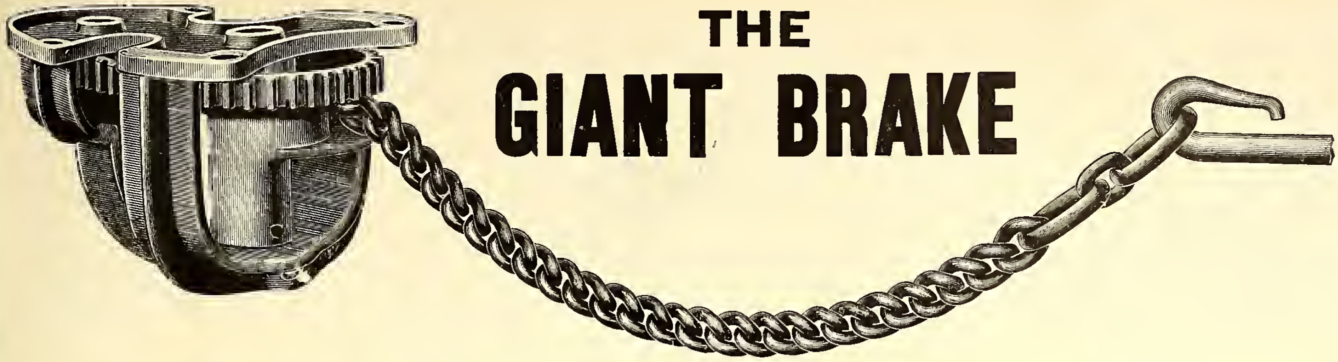
Electric Driven Pumps
for any Service

Fairbanks-Morse Motors and Pumps show excellent economy

Send for Bulletin No. 523EP

FAIRBANKS, MORSE & CO.
Main Office: CHICAGO, ILL.

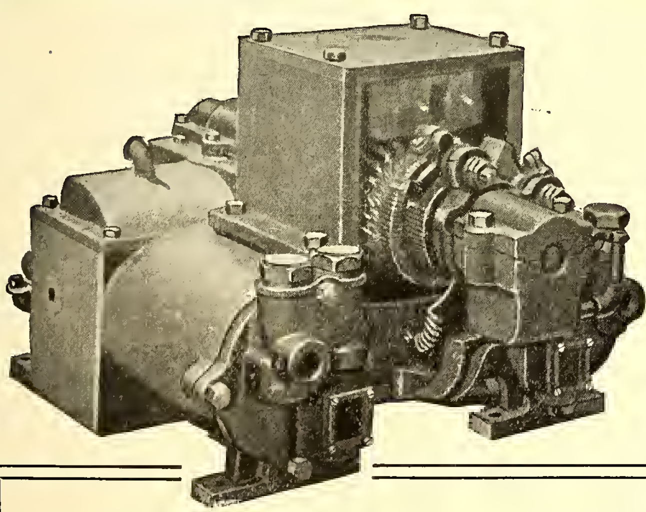
INDEX TO ADVERTISERS—Continued.



THE GIANT BRAKE

This brake is constructed in accordance with sound and well established mechanical principles as related to braking. There is nothing freaky or sensational about it. The balance between power and quickness is the happy medium, resulting from many years' experience on thousands of cars. If in market for brakes, try it.

STERLING-MEAKER CO., Owner, Newark, N. J.



Air Brakes——1

——Our Compressor

is geared up with the Morse-Henley worm and gear, the most nearly perfect power transmission in existence. It gives power, and lasts at least three times as long as ordinary gear and pinion transmission.

That's one of many reasons why our air brakes cost so little for maintenance.

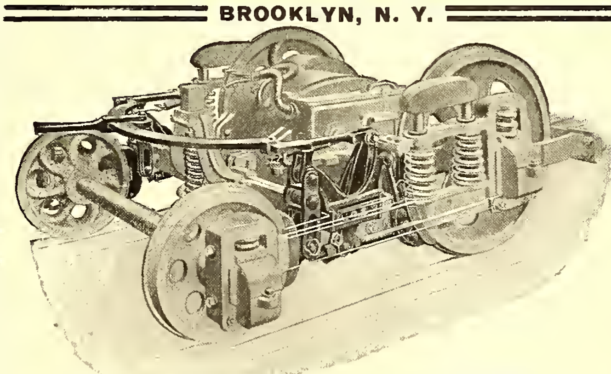
Philadelphia Air Brake Co.
Real Estate Trust Bldg., Philadelphia, Pa.

COLUMBIA MACHINE WORKS

AND MALLEABLE IRON COMPANY

MANUFACTURERS OF ELECTRIC RAILWAY SUPPLIES

BROOKLYN, N. Y.



PATENTED

Columbia Brake for Pony Truck

MOST EFFICIENT BRAKE IN USE.
BRAKES ARE BETWEEN WHEELS
DOES AWAY WITH BRAKE BEAMS
NO LONG CHAINS.
NO FLAT WHEELS
SIMPLE IN ADJUSTMENT.
COMPLETE SET OF SHOES.
CHANGED IN TWENTY MINUTES
SHOES WEAR EQUAL ON ALL WHEELS
BREAKS ARE ADJUSTED INDEPENDENTLY EITHER SIDE.
BRAKE IS QUICK ACTING.
REQUIRES ONLY THREE-QUARTER TURN OF HANDLE APPLY
YOUR OLD BRAKES CAN BE REMOVED AND NEW BRAKE APPLIED AT SMALL EXPENSE.
MAKES YOUR TRUCKS STRONGER
GIVES MORE ROOM FOR MOTORS.
DOES AWAY WITH OFFSET BRAKE RODS.
STOPS CHATTERING OF BRAKE SHOES.

PRICES QUOTED ON APPLICATION

CLASSIFIED DIRECTORY

OF MANUFACTURERS, MANUFACTURERS' AGENTS, ENGINEERS, CONTRACTORS, BANKERS, BROKERS, Etc., Etc.

NOTE—For reference to the advertisements, see alphabetical index on pages 15-19. *Indicates advertisements appearing only in the International edition.

Accountants and Auditors
The Audit Co. of Illinois.

Advertising (Street Car)
Petry, Ambrose, Co.

Alloys and Bearing Metals
(See also Bearings for Trucks and Motors.)
Brown, Harold P.
Harrison, F. P., Electric & Mfg. Co., Inc.
Lehman Bros.
Mayer & Englund Co.
Morris, Elmer P.
New Era Mfg. Co.
Newell, J. F., & Co.
Ohio Brass Co.
Phosphor Bronze Smelting Co., Ltd., The.
Pittsburgh White Metal Co.
Ridlon Co., Frank.

Alternators
(See Generators, Alternating Current.)

Amusement Attractions
American Mutoscope & Biograph Co.
Electric Launch Co.
Gorman, J. W.
Henley, M. C.
Herschell, Spillman Co.
Ingersoll Construction Co.
Ingersoll, Frederick.
Keith, B. F.
Kinetograph Co.
Miles Bros.
Miniature Railroad Co.
National Phonograph Co.
Richardson Ball Bearing Skate Co.
Traver Circle Swing Co.
Twentieth Century Optiscope Co.
Union Hardware Co.
Vitagraph Co. of America.
Winslow, Sam'l, Skate Mfg. Co.

Anchors (Guy)
Garton, W. R., Co.
Matthews & Bro., W. N.
Nagel, W. G. Elec. Co.
Wapak Hollow Ware Co.

Armature and Field Coils
(Including Winding and Handling Methods)
American Gen'l Engineering Co.
Chattanooga Armature Works.
Cleveland Armature Works.
Columbia Machine Works & Malleable Iron Co.
Comstock & Co., J. F.
Electric Cable Co.
Dittrick& Jordan Electric Co.
Elliott Bros. Electric Co.
Garton, W. R., Co.
General Electric Co.
Griswold, Geo. M.
Harrison, F. P. Electric & Mfg. Co., Inc.
Magnet Wire Co.
McLeer Engineering Co.
Ridlon, Frank, Co.
Roebling's, John A., Sons Co.
Rossiter, MacGovern & Co.
Van Dorn-Elliott Electric Co.
Van Loan, I. S., Co.
Waterbury & Co.

Armature Lifts
(See Cranes and Hoists.)

Automobiles
Fairbanks, Morse & Co.
*Peebles Steam Car Co., Ltd.

Babbitting Devices
Ridlon, Frank, Co.

Babbitt Metals
(See Alloys and Bearing Metals.)

Badges and Buttons
American Railway Supply Co.
International Register Co.
Recording Fare Register Co.
Waterbury Button Co.

Ballast Cars and Ballasting Machinery
Allis-Chalmers Co.

Bankers and Brokers
Dumee, Son & Co.
Farlow, W. E., & Co.
Farson, Leach & Co.
Harris, N. W., & Co.
Hayes, W. J., & Sons.
Hurry, R. I., & Co.
Perry, Coffin & Burr.
Phillips, S. A.
Trask, Spencer, & Co.

Bases, Trolley
Garton, W. R., Co.
Morris, Elmer P.
*Mountain & Gibson, Ltd.
Nuttall, R. D., Co.
Recording Fare Register Co.

Batteries
Electric Storage Battery Co.
General Storage Battery Co.
Gould Storage Battery Co.
Hatch Accumulator Co.
National Battery Co.
Wesco Supply Co.

Bearings for Trucks and Motors
(See also Alloys and Bearing Metals.)
Baltimore Railway Specialty Co.
General Electric Co.
Harrison, F. P., Electric & Mfg. Co., Inc.
Morris, Elmer P.
Newell, T. F., & Co.
Ohio Brass Co.
Ridlon, Frank, Co.
St. Louis Car Co.
Taylor Electric Truck Co.

Bells and Gongs
Brill, J. G., Co.
Garton, W. R., Co.
Ohio Brass Co.
Wallace Supply Co.

Belting
Boyle, John, & Co.

Belt Lacing
Bristol Co.

Benders, Rail
Fairbanks, Morse & Co.
Kalamazoo Railway Supply Co.
Macleod, Walter, & Co.
Niles-Bement-Pond Co.
Railway Appliances Co.

Bending Tools
Niles-Bement-Pond Co.
Wallace Supply Co.

Block Systems
(See Signal Systems.)

Blowers
(See Mechanical Draft Apparatus.)

Blue Printing Machines
Buckeye Engine Co.
Williams, Brown & Earle.

Boiler Cleaners, Mechanical
Lagonda Mfg. Co.

Boilers
Babcock & Wilcox Co.
*Babcock & Wilcox Co., Ltd.
*Borsig, A.
Heine Safety Boiler Co.
*Howden, Jas., & Co.
Parker Boiler Co.
Phœnix Iron Works Co.
Stirling Consolidated Boiler Co.
Wetherill, Robt., & Co.

Boiler Cleaning Compounds
Dearborn Drug & Chemical Wks.

Boiler Coverings
(See Coverings, Pipe and Boiler.)

Bonds, Rail
Bissell, F., Co.
Brown, Harold P.
Chase-Shawmut Co.
Clark Electric & Mfg. Co.
*Forest City Electric Co.
Garton, W. R., Co.
Goldschmidt Thermit Co.
General Electric Co.
General Railway Supply Co.
Lorain Steel Co.
Lord Electric Co.
Mayer & Englund Co.
Porter & Berg.
Protected Rail Bond Co.
Ohio Brass Co.
Roebling's, John A., Sons Co.
Stuart-Howland Co.
Wesco Supply Co.

Bond Testers
Machado & Roller.
Whitney Electric'l Instrument Co.

Bonding Tools
(See Tools, Track and Miscellaneous.)

Boosters
Allis-Chalmers Co.
General Electric Co.
National Electric Co.

Borers, Wheel
(See Machine Tools.)

Boxes, Journal
(See Journal Boxes.)

Brackets and Cross Arms
Bissell, F., Co.
Creaghead Engineering Co.
Garton, W. R., Co.
Mayer & Englund Co.
Ohio Brass Co.
Porter & Berg.
Southern Exchange Co.
Stuart-Howland Co.
Western Electric Co.

Brakes, Brake Systems and Brake Parts
Baker, John S.
Brill, J. G., Co.
Columbia Machine Works & Malleable Iron Co.
General Electric Co.
Magann Air Brake Co., Ltd.
*Mountain & Gibson, Ltd.
National Brake Co.
National Electric Co.
Philadelphia Air Brake Co.
Porter & Berg.
St. Louis Car Co.
Sterling-Meaker Co.
Taylor Electric Truck Co.
Traction Equipment Co.
U. S. Metal & Mfg. Co.
Westinghouse Air Brake Co.
*Westinghouse Brake Co., Ltd.

Brake Shoes
American Brake Shoe & Foundry Co.
Bissell, F., Co.
Brill, J. G., Co.
Dorner Mfg. Co.
Long, E. G.
Porter & Berg.
St. Louis Car Co.
Standard Brake Shoe Co.
Taylor Electric Truck Co.
Wesco Supply Co.
Wheel Truing Brake Shoe Co.

Brazing Processes
American Ferrofix Brazing Co.

Brick
Mack Mfg. Co.
Harbison-Walker Refractories Co.

Bridges and Buildings
American Bridge Co.
Central States Bridge Co.
Gilbreth, Frank B.
Pratt, Mason D.
Trussed Concrete Steel Co.

Brushes, Carbon
Bissell, F., Co.
General Electric Co.
National Carbon Co.
Porter & Berg.
Speer Carbon Co.
Stuart-Howland Co.

Bumpers, Car
Brill, J. G., Co.

Bumpers, Car Seat
Elastic Tip Co.

Bushings
(See Wheels and Bushings Trolley.)

Buttons
(See Badges and Buttons.)

Cables
(See Wires and Cables.)

Calculating Machines
(See Computing Machines.)

Carbon Brushes
(See Brushes, Carbon.)

Cars, Passenger, Freight and Express
American Car Co.
American Car & Foundry Co.
Brill, J. G., Co.
*Brush Electrical Engineering Co., Ltd.
Cincinnati Car Co.
Dorner Mfg. Co.
*Electric Railway & Tramway Carriage Works.
Hammond, J., & Co.
Hanna, J. A., Co.
Jewett Car Co.
Kuhlman, G. C., Car Co.
Laconia Car Co. Works.
*Maschinenfabrik Oerlikon.
Morris, Elmer P.
Niles Car & Mfg. Co.
*Peebles Steam Car Co.
St. Louis Car Co.
Stephenson, John, Co.
*United Electric Car Co.

Cars, Pressed Steel
American Car & Foundry Co.
Pressed Steel Car Co.

Cars, Portable Sub-Station
Brill, J. G., Co.

Cars, Construction and Repair
Fairbanks, Morse & Co.
Kalamazoo Railway Supply Co.
Railway Appliances Co.

Car Equipment
(For Fenders, Heaters, Registers, Wheels, etc., see those headings.)

Car Seat Bumpers
(See Bumpers, Car Seat.)

Car Trimmings
(See also Curtains and Curtain Fixtures, Registers and Register Fittings, etc.)
Morris, Elmer P.
Recording Fare Register Co.
Wallace Supply Co.

Castings
American Brake Shoe & Foundry Co.
American Bridge Co.
Beaver Dam Malleable Iron Co.
Columbia Machine Works & Malleable Iron Co.
Falk Co.
Laconia Car Co. Works.
Morris, Elmer P.
Ohio Brass Co.
Ridlon, Frank, Co.

Cast Welded Joints
(See Joints, Rail.)

Catchers and Retrievers, Trolley
Garton, W. R., Co.
Ridlon, Frank, Co.
Stuart-Howland Co.
Trolley Supply Co.
*Wilson & Co.

Cattle Guards
(See Stock Guards.)

Cement
Johns, H. W., Manville Co.

Change Carriers
Bellamy Vestlette Mfg. Co.

Chains
American Bridge Co.
Jeffrey Mfg. Co.
Taylor Electric Truck Co.

Chimneys
Power & Mining Machinery Co.
Weber Steel Concrete Chimney Co.

Circle Swing
Traver Circle Swing Co.

Circuit Breakers
American Gen'l Engineering Co.
Bissell, F., Co.
*British Thomson-Houston Co.
*British Westinghouse Electric & Mfg. Co.
Condit Electrical Mfg. Co.
Cutter Co.
General Electric Co.
*Nalder Bros. & Thompson.

"THERMIT"

TRADE MARK REGISTERED

The Thermit Weld Preserves Perfect Surface.

It is a matter of common knowledge that plated and belted rails invariably give way at the joint, long before the rail proper gives signs of wear, by reason of the receiving-ends becoming "dished" by the constant hammering of passing cars.

Experience has proved the impossibility of maintaining perfect, permanent surface with any practicable form of bolted fish-plate. Bolts will work loose despite close inspection and frequent repairs, and rail ends pound down and wear out long before the head of the rail is worn down to a point requiring renewal.

THERMIT welds the rail ends absolutely one to the other. The hot THERMIT steel (5400° F.) completely fuses the rail ends, amalgamates with the metal of the base and web, and on cooling gives an absolutely continuous rail.

The "joint" (which is actually eliminated) thus becomes as strong as the rail itself, and positively will not deteriorate more rapidly than the rail itself.

The reduction on maintenance costs results in a large saving of labor on repairs to track and paving.

100%
PERMANENT
CONDUCTIVITY

It will pay you to write for our literature and to investigate thoroughly.

A TRUE
CONTINUOUS
RAIL

GOLDSCHMIDT THERMIT CO.

43 EXCHANGE PLACE, NEW YORK CITY

CLASSIFIED DIRECTORY—Continued.

Ohio Brass Co.
Porter & Berg.
Stuart-Howland Co.
Wesco Supply Co.
Westinghouse Electric & Mfg. Co.

Clamps and Connectors for Wires and Cables
Clark Electric & Mfg. Co.
Matthews, W. N., & Bro.
Ridlon, Frank, Co.

Cleaners and Scrapers, Track
Brill, J. G., Co.
Dorner Mfg. Co.
Kalamazoo Railway Supply Co.
Ohio Brass Co.
Van Dorn & Dutton Co.
Wesco Supply Co.

Cleaners, Boiler
(See Boiler Cleaners.)

Cleaning Powders and Washes
De Ronde, Frank S.
India Alkali Works.
Young & Co., Robert.

Clusters and Sockets
Benjamin Electric & Mfg. Co.
General Electric Co.

Coaches, Motor
Railway Appliances Co.

Coal Handling Machinery
(See Conveyors.)

Coils, Armature and Field
(See Armatures and Field Coils.)

Commutators and Parts
Cameron, H. P., Electrical & Mfg. Co.
Cleveland Armature Works.
Columbia Machine Works & Malleable Iron Co.
General Electric Co.
*Forest City Electric Co.
Harrison, F. P., Electric & Mfg. Co., Inc.
Homer Commutator Co.
Ohio Brass Co.
Porter & Berg.
Ridlon, Frank, Co.
Rossiter, MacGovern & Co.
Stuart-Howland Co.
Van Dorn-Elliott Electric Co.
Van Loan, I. S., Co.
Wesco Supply Co.
Westinghouse Electric & Mfg. Co.
Wickes Bros.

Commutator Compounds and Truing Devices
Jordan Automatic Electric Signal Co.
Ridlon, Frank, Co.

Compounds, Boiler Cleaning
(See Boiler Cleaning Compounds.)

Compounds, Insulating
(See Insulations and Insulating Compounds.)

Compressors, Air
Allis-Chalmers Co.
Christensen, N. A.
Clayton Air Compressor Works.
General Electric Co.
National Electric Co.
Westinghouse Air Brake Co.

Computing Machines
Hamburger, Felix.

Concrete Steel
(See Bridges and Buildings.)

Condensers
Alberger Condenser Co.
Allis-Chalmers Co.
Blake, W. H., Steam Pump Wks.
Bulkley, Henry W.
Watson Machine Co.
Wheeler Condenser & Engineering Co.
Worthington, Henry R.

Conductor's Vestlettes
Bellamy Vestlette Mfg. Co.

Conduits, Underground
Bissell, F., Co.
Gest, Guy M.

Control Systems
General Electric Co.
Westinghouse Electric & Mfg. Co.

Controllers & Controller Parts
*British Thomson-Houston Co.
General Electric Co.
Harrison, F. P., Electric & Mfg. Co., Inc.
*Maschinenfabrik Oerlikon.
Westinghouse Electric & Mfg. Co.

Controller Regulators
Durkin Controller Handle Co.
Equipment Protection Co.
Garton-Daniels Co.

Converters, Rotary
Allis-Chalmers Co.
General Electric Co.
National Electric Co.
Westinghouse Electric & Mfg. Co.

Conveyors, Coal and Ashes
(Including Auxiliary Apparatus)
American Gen'l Engineering Co.
*Babcock & Wilcox, Ltd.
Brown Hoisting Machinery Co.
Jeffrey Mfg. Co.
Mead, John A., & Co.

Cooling Towers
(See Towers, Cooling.)

Cord, Bell and Trolley
American Gen'l Engineering Co.
Bissell, F., Co.
International Register Co.
Mayer & Englund Co.
Porter & Berg.
Recording Fare Register Co.
Samson Cordage Works.
Silver Lake Co.
Sterling-Meaker Co.
Stuart-Howland Co.

Cotton Duck
Boyle, John, & Co.

Couplers, Car
Brill, J. G., Co.
Van Dorn, W. T., Co.
Wallace Supply Co.
Washburn, Edwin C.
Westinghouse Air Brake Co.

Coverings, Pipe and Boiler
Johns-Manville Co., H. W.

Cranes, Hoists and Lifts
American Gen'l Engineering Co.
Brill, J. G., Co.
Brown Hoisting Machinery Co.
Case Mfg. Co.
Cleveland Armature Works.
Duff Mfg. Co.
Marine Engine & Machine Co.
Maris Bros.
Niles-Bement-Pond Co.
Northern Engineering Works.
Van Dorn & Dutton Co.

Cross Arms
(See Brackets and Cross Arms.)

Crossings, Track
(See Track Work.)

Crucibles
McCullough-Dalzell Crucible Co.

Curtains, Curtain Fixtures and Curtain Material
Boyle, John, & Co.
Brill, J. G., Co.
Curtain Supply Co.
Edwards, O. M., Co.
Hartshorn, Stewart Co.
Heywood Bros. & Wakefield Co.
Pantasote Co.
*Peters, G. D., & Co.

Damper Regulators
Lagonda Mfg. Co.

Derailing Devices
(See also Track Work.)
Lorain Steel Co.
Weir Frog Co.

Detective Service
Drummond's Detective Agency.
Heath's Inspector Service.
Mooney & Boland Detective Agency.

Doors and Door Fixtures
Brill, J. G., Co.
Pitt Car Gate Co.
Ridlon, Frank, Co.
Wallace Supply Co.

Doors, Steel Rolling
Kinnear Mfg. Co.

Draft, Mechanical
(See Mechanical Draft Apparatus.)

Draft Rigging and Draw Bars
(See Couplers, Car.)

CLASSIFIED DIRECTORY—Continued.

Drying Apparatus
(See also Heating and Ventilating Apparatus.)
American Blower Co.
American Process Co.
Sturtevant, B. F., Co.

Drills, Track
Bissell, F., Co.
Brown, Harold P.
Cook's Railway Appliance Co.
Fairbanks, Morse & Co.
Kalamazoo Railway Supply Co.
Niles-Bement-Pond Co.
Porter & Berg.
Ridlon, Frank, Co.
Van-Dorn-Elliott Electric Co.
Wesco Supply Co.

Dust Guards
(See Lubricating Devices.)

Dynamos
(See Generators.)

Economizers, Fuel
Green Fuel Economizer Co.
Parker Boiler Co.
Sturtevant, B. F., Co.

Electrical Testing
Buffalo Testing Laboratory.
Electrical Testing Laboratories.

Elevators
Marine Engine & Machine Co.
Power & Mining Machinery Co.

Engines, Gas and Oil
Allis-Chalmers Co.
Buckeye Engine Co.
De La Vergne Machine Co.
Power & Mining Machinery Co.
Westinghouse Machine Co.

Engines, Hoisting
Allis-Chalmers Co.

Engines, Steam
Allis-Chalmers Co.
American Blower Co.
Ball & Wood Co.
*Borsig, A.
*British Westinghouse Electric & Mfg. Co.
*Brush Electrical Engineering Co.
Buckeye Engine Co.
Cooper, C. & G., Co.
Harrisburg Foundry & Machine Works.
Hooven-Owens-Rentschler Co.
*Howden, Jas., & Co.
McIntosh, Seymour & Co.
Marine Engine & Machine Co.
*Maschinenfabrik Oerlikon.
Phœnix Iron Works Co.
Providence Engineering Works.
*Stewart, D., & Co. (1902), Ltd.
Sturtevant, B. F., Co.
*Tosi, Franco.
Westinghouse Machine Co.
Wetherill, Robt., & Co.
Wheeler Condenser & Engineering Co.

Engineers, Consulting, Contracting and Operating
American Gen'l Engineering Co.
Arbuckle-Ryan Co.
Arnold Co.
Atlas Contract & Supply Co.
Baker, W. E., & Co.
Bates, Putnam A.
Blood & Hale.
*British Westinghouse Electric & Mfg. Co.
Byllesby, H. M., & Co.
Chapman, Chas. A.
Cleveland Armature Works.
Coleman, Jilson J.
Columbia Construction Co.
Cudworth, Axtell & Co.
Cullen, Wm. A.
Electrical Installation Co.
Eldenbel Construction Co.
Engstrom, Axel H.
Fidelity Construction Co.
Ford, Bacon & Davis.
Gest, Guy M.
Gilbreth, Frank B.
Herrick, Albert B.
Hunt, Rob't W., & Co.
Kitfield, Edw. H.
Knox Engineering Co.
Kohler Bros.
Ley, Fred T. & Co.
*Mountain & Gibson, Ltd.
Myers, L. E., Co.
Pepper & Bowie.
Pierce, Richardson & Neiler.
Pratt, Mason D.
Reed, Wm. S.
Register, A. L., & Co.
Roberts & Abbott Co.
Sanderson & Porter.
Sargent & Lundy.
Saxton, E.
Schott, W. H.
Sheaff & Jaastad.
Smethurst & Allen.
Van Bibber, C. E.
Wagner, Herbert A.
White, J. G., & Co.
*White, J. G., & Co., Ltd.

Exhaust Heads
Burt Mfg. Co.
Hoppes Mfg. Co.

Extinguishers, Fire
(See Fire Extinguishers.)

Fans
(See Mechanical Draft Apparatus.)

Feed-Water Apparatus
(See Heaters and Purifiers, Feed-Waters.)

Felts, Fireproof
Johns-Manville, H. W., Co.

Fenders and Wheel Guards
Consolidated Car Fender Co.
Mayer & Englund Co.
*Mountain & Gibson, Ltd.
Parmenter Fender & Wheel Guard Co.
Star Brass Works.
Sterling-Meaker Co.
Stuart-Howland Co.
Traction Equipment Co.
Wesco Supply Co.

Fibre
American Vulcanized Fibre Co.
Bissell, F., Co.
Porter & Berg.

Field Coil Cushions
Massachusetts Chemical Co.

Field Coils
(See Armature and Field Coils.)

Filters, Oil
Oil & Waste Saving Machine Co.
Turner, M. A.
*Vacuum Oil Co.

Fire Extinguishers
American Gen'l Engineering Co.
General Fire Extinguisher Co.
International Sprinkler Co.
Manufacturers' Automatic Sprinkler Co.
Vogel, H. G., Co.

Fireproofing Materials
(See also Lumber, Artificial.)
Johns-Manville, H. W., Co.

Flanges, Welded
Ball & Wood Co.

Forges
Sturtevant, B. F., Co.

Frogs, Track
(See Track Work.)

Fuel Economizers
(See Economizers, Fuel.)

Furnaces
Murphy Iron Works.

Fuses and Fuse Boxes
American Gen'l Engineering Co.
Bissell, F., Co.
Chase-Shawmut Co.
D. & W. Fuse Co.
General Electric Co.
Johns-Manville Co., H. W.
Mayer & Englund Co.
Porter & Berg.
Stuart-Howland Co.
Westinghouse Electric & Mfg. Co.

Gas Producers
Power & Mining Machinery Co.
Westinghouse Machine Co.

Gates, Car
Bliss, R., Mfg. Co.
Brill, J. G., Co.
Pitt Car Gate Co.

Gates, Water
(See Valves and Gates.)

Gear Cases
Bliss, E. W., Co.
Garton, W. R., Co.
General Electric Co.
Mayer & Englund Co.
Stuart-Howland Co.

Gears and Pinions
Bliss, E. W., Co.
Falk Co.
Garton, W. R., Co.
General Electric Co.
General Railway Supply Co.
Long, E. G.

CLASSIFIED DIRECTORY—Continued.

Mayer & Englund.
New Process Raw Hide Co.
Nuttall, R. D., Co.
Ohio Brass Co.
Stuart-Howland Co.
Van Dorn & Dutton Co.
Wesco Supply Co.

Generators, Alternating Current
Allis-Chalmers Co.
Crocker-Wheeler Co.
General Electric Co.
National Electric Co.
Westinghouse Electric & Mfg. Co.

Generators, Direct Current
Allis-Chalmers Co.
*British Westinghouse Electric & Mfg. Co.
*British Thomson-Houston Co.
*Brush Electrical Engineering Co.
Crocker-Wheeler Co.
*Dick, Kerr & Co.
*Electric Construction Co.
General Electric Co.
National Electric Co.
*Peebles & Co., Bruce.
Westinghouse Electric & Mfg. Co.

Generators, Gas
(See Gas Producers.)

Generating Sets
Allis-Chalmers Co.
Marine Engine & Machine Co.
Sturtevant, B. F., Co.

Generators and Motors, Spare Parts of
Crocker-Wheeler Co.

Gongs
(See Bells and Gongs.)

Graphite Paints
(See Paints and Varnishes.)

Greases
(See Lubricants.)

Grinders
Brown, Harold P.
Cook's Railway Appliance Co.
Niles-Bement-Pond Co.
Royal Mfg. Co.

Guards, Cattle
(See Stock Guards.)

Gums
Eastern Electric Cable & Wire Co.

Gutta Percha or Rubber Insulation
(See Insulations and Insulating Compounds.)

Handles, Controller
(See Controller Regulators.)

Harps, Trolley
Bayonet Trolley Harp Co.
Fairbanks, Morse & Co.
Harrison, F. P., Electric & Mfg. Co., Inc.
Kalamazoo Railway Supply Co.
Liberty Bell Co.
Morris, Elmer P.
*Mountain & Gibson, Ltd.
Nuttall Co., R. D.
Porter & Berg.
Recording Fare Register Co.
Ridlon Co., Frank.
Star Brass Works.
Wesco Supply Co.

Headlights
Bissell, F., Co.
Fairbanks, Morse & Co.
Garton, W. R., Co.
General Electric Co.
Macleod, Walter, & Co.
Porter & Berg.
Ridlon Co., Frank.
Smith of New York Co.
St. Louis Car Co.
Stuart-Howland Co.
Trolley Supply Co.

Heaters, Car (Electric)
Consolidated Car Heating Co.
Gold Car Heating & Lighting Co.
Johns-Manville Co., H. W.
Simplex Electric Heating Co.

Heaters, Car, Hot Water and Stoves
Dorner Mfg. Co.
Gold Car Heating & Lighting Co.
Smith Heater Co., Peter.

Heaters and Purifiers, Feedwater
(Including Feed-water Regulators)
Alberger Condenser Co.
*Babcock & Wilcox, Ltd.
Harrison Safety Boiler Co.
Hoppes Mfg. Co.
Johns-Manville Co., H. W.
Phœnix Iron Works Co.
Wetherill & Co., Robert.
Wheeler Condenser & Engineering Co.

Heating and Ventilating Apparatus
(See also Mechanical Draft.)
American Blower Co.
American District Steam Co.
Green Fuel Economizer Co., The.
Sturtevant Co., B. F.

Hoists
(See Cranes, Hoists & Lifts.)

Hose Bridges
Ohio Brass Co., The.

Hose, Cotton
Boyle & Co., John.

Hydraulic Machinery
Allis-Chalmers Co.
Niles-Bement-Pond Co.

Impregnating Compounds
(See also Vacuum Impregnating Apparatus.)
Standard Varnish Works.

Instruments, Electrical Measuring
American Instrument Co.
General Electric Co.
Machado & Roller.
*Nalder Bros. & Thompson.
Westinghouse Electric & Mfg. Co.
Weston Electrical Instrument Co.
Whitney Electrical Instrument Co.

Instruments, Recording
Bristol Co., The.
General Electric Co.

Insulations and Insulating Compounds
(See also Paints and Varnishes.)
American Gen'l Engineering Co.
Anderson Mfg. Co., Albert & J. M.
Bissell, F., Co.
Garton, W. R., Co.
General Electric Co.
Harrison, F. P., Electric & Mfg. Co., Inc.
Johns-Manville Co., H. W.
Macon-Evans Varnish Co.
Massachusetts Chemical Co.
Ohio Brass Co.
Okonite Co., Ltd., The.
Porter & Berg.
Standard Paint Co., The.
Standard Underground Cable Co.
Sterling Varnish Co.
*Vereinigte Isolatorenwerke Aktien-Gesellschaft.
Wesco Supply Co.
Western Electric Co.

Insulating Cement
Massachusetts Chemical Co.

Insulating Paper and Cloths
American Gen'l Engineering Co.
American Vulcanized Fibre Co., The.
General Electric Co.
Harrison, F. P., Electric & Mfg. Co., Inc.
Hope Webbing Co.
Macon-Evans Varnish Co.
Massachusetts Chemical Co.
Standard Paint Co.
Sterling Varnish Co.

Insulating Tapes
American Gen'l Engineering Co.
Garton, W. R., Co.
General Electric Co.
Harrison, F. P., Electric & Mfg. Co., Inc.
Hope Webbing Co
Massachusetts Chemical Co.
Standard Paint Co.

Insulators (Including Third Rail)
(See also Line Material.)
Bissell, F., Co.
Creaghead Engineering Co.
*Dixon, S., & Son, Ltd.
General Electric Co.
Johns-Manville Co.
Morris, Elmer P.
Ohio Brass Co.
Porter & Berg.
Reconstructed Granite Co.
Western Electric Co.

CLASSIFIED DIRECTORY—Continued.

Inventions Developed and Perfected
Peters, G. D., & Co.

Jacks
(See also Cranes, Hoists & Lifts.)
American Gen'l Engineering Co.
Brill, J. G., Co.
Buckeye Jack Mfg. Co.
Cook's Railway Appliance Co.
Dorner Mfg. Co.
Duff Mfg. Co.
Fairbanks, Morse & Co.
Kalamazoo Railway Supply Co.
Ohio Brass Co.
Porter & Berg.

Joints, Expansion
(See Pipe Fittings.)

Joints, Rail
Atlas Railway Supply Co.
Continuous Rail Joints.
Falk Co.
Goldschmidt Thermit Co.
Lorain Steel Co.
Rail Joint Company.
Weber Railway Joints.

Journal Boxes
Brill, J. G., Co.
Symington, T. H., Co.

Journal Lubricators
(See Lubricating Devices.)

Laboratories, Electrical
Buffalo Testing Laboratory.
Electrical Testing Laboratories.

Lamps, Arc and Incandescent
(See also Headlights.)
Bissell, F., Co.
Creaghead Engineering Co.
Garton, W. R., Co.
General Electric Co.
Mayer & Englund Co.
Porter & Berg.
Smith of New York Co.
Stuart-Howland Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

Lamp Parts
(See Clusters and Sockets.)

Lanterns
Smith of New York Co.

Laughing Galleries
Ingersoll Construction Co.

Launches, Electric
Electric Launch Co.

Lifters, Car Step
Consolidated Car Fender Co.

Lifts
(See Cranes, Hoists and Lifts.)

Lightning Protection
Garton, W. R., Co.
Anderson, A. & J. M., Mfg. Co.
Bissell, F., Co.
General Electric Co.
Garton-Daniels Co.
Lord Electric Co.
Ohio Brass Co.
Porter & Berg.
Stuart-Howland Co.
Wesco Supply Co.
Westinghouse Electric & Mfg. Co.

Line Material
(See also Brackets and Cross Arms, Insulators and Wires and Cables.)
*Ambroin Werke.
Anderson Mfg. Co., Albert & J. M.
*British Thomson-Houston Co.
Creaghead Engineering Co.
*Dick, Kerr & Co.
*Dixon, S., & Son, Ltd.
Electric Railway Equipment Co.
Garton, W. R., Co.
Harrison, F. P., Electric & Mfg. Co., Inc.
Johns-Manville Co., H. W.
Macallen Co., The.
*Maschinenfabrik Oerlikon.
Morris, Elmer P.
Ohio Brass Co., The.
Mayer & Englund Co.
Porter & Berg.
Recording Fare Register Co.
Stuart-Howland Co.
Vereinigte Isolatorenwerke Aktien-Gesellschaft.
Western Electric Co.

Lockers, Metal
Darby, Edw., & Sons, Co.
Merritt & Co.
Meyers, Fred J., Mfg. Co.
Porter & Berg.

Lock Nuts and Washers
(See Nuts and Bolts.)

Locomotives, Electric
Baldwin Locomotive Works.
*Borsig, A.
Brill Co., J. G.
*British Thomson-Houston Co.
General Electric Co.
*Mountain & Gibson, Ltd.
Westinghouse Electric & Mfg. Co.

Lubricants, Oil and Grease
Borne, Scrymser Co.
Champion Oil Co.
Dearborn Drug & Chemical Co.
Franklin Oil & Gas Co.
Galena Signal Oil Co.
Monitor Oil Co.

Lubricating Devices
Armstrong Oiler Co.
Jolt Lubricator Co.

Lumber, Artifical
Johns-Manville Co., H. W.

Machine Tools
Niles-Bement-Pond Co.

Machinists' Tools
Niles-Bement-Pond Co.

Mechanical Draft Apparatus
(See also Heating and Ventilating Apparatus.)
American Blower Co.
General Electric Co.
Green Fuel Economizer Co.
Sturtevant Co., B. F.

Merry-Go-Rounds
Herschell-Spillman Co.

Minature Railroads
Herschell-Spillman Co.
Miniature Railroad Co.

Motors, Electric
Allis-Chalmers Co.
*British Thomson-Houston Co.
*British Westinghouse Electric & Mfg. Co.
*Brush Electrical Engineering Co.
Cleveland Armature Works.
Crocker-Wheeler Co.
*Dick, Kerr & Co.
General Electric Co.
*Maschinenfabrik Oerlikon.
National Electric Co.
Sturtevant Co., B. F.
Westinghouse Electric & Mfg. Co

Mirrors for Motormen
Brown, Harold P.

Moulded Rubber
Massachusetts Chemical Co.

Movers, Car
(See Pushers, Car.)

Moving Picture Machines
American Mutoscope & Biograph Co.
Kinetograph Co.
Miles Bros.
Twentieth Century Optiscope Co.
Vitagraph Co. of America.

Multiple Unit Control
(See Control Systems.)

CLASSIFIED DIRECTORY—Continued.

Nuts and Bolts
American Lock Nut Co.
Bliss Co., E. W.
Lorain Steel Co.
National Lock Washer Co.
Smith Improved Lock Nut Co.
U. S. Metal & Mfg. Co.

Ohmmeters
Machado & Roller.
Whitney Electrical Instrument Co.

Oils
(See Lubricants.)

Oil Eliminators
Hoppes Mfg. Co.

Oil Filters
(See Filters, Oil.)

Overhead Equipment
(See Line Material.)

Packing
American Gen'l Engineering Co.
Johns-Manville Co., H. W.
Power Specialty Co.

Paints and Varnishes
(See also Insulating Compounds.)
American Gen'l Engineering Co.
Atlas Railway Supply Co.
Detroit Graphite Mfg. Co.
Garton, W. R., Co.
Macon-Evans Varnish Co.
Massachusetts Chemical Co.
Morris, Elmer P.
Sherwin-Williams Co.
Standard Paint Co.
Standard Varnish Works.
Sterling Varnish Co.

Panels, Seat End
Brill Co., J. G.

Park Attractions
(See Amusement Attractions.)

Patent Attorneys
Rosenbaum & Stockbridge.

Paving Material
American Brake-Shoe & Fdy. Co.
Harbison-Walker Refractories Co.
Mack Mfg. Co.
U. S. Wood Preserving Co.

Phosphor Bronze
(See Alloys.)

Pinions
(See Gears and Pinions.)

Pins, Wood and Iron
Bissell, F., Co.
Morris, Elmer P.

Pipe Coverings
(See Coverings, Pipe.)

Pipe Fittings
Alberger Condenser Co.
Ball & Wood Co.
Crane Co.

Planers
(See Machine Tools and Woodworking Machinery.)

Plows, Snow
(See Snow Plows and Sweepers.)

Poles, Ties and Lumber
Abeles & Taussig.
Bissell, F., Co.
Beidler & Co., Francis.
Churchill Cedar Co.
Fowler & Co., John H.
Glenn-Kline Lumber Co.
Groves, D. G., & Co.
Hearne Timber Co.
Humbird Lumber Co.
Maus & Co., H. H.
Moss Tie Co., T. J.
Naugle Pole & Tie Co.
Southern Exchange Co.
Worcester Co., C. H.

Poles, Trolley
Columbia Machine Works.
Garford Co., The.
Garton, W. R., Co.
Harrison, F. P., Electric & Mfg. Co., Inc.
*Mountain & Gibson, Ltd.
Recording Fare Register Co.

Poles, Metal Street
American Bridge Co.
Bissell, F., Co.
Creaghead Engineering Co.
Electric Railway Equipment Co.
Fairbanks, Morse & Co.
Garton, W. R., Co.
Morris, Elmer P.
Porter & Berg.
Wesco Supply Co.

Poles, Metal (Protected Sleeve for)
Gherky, Wm. D.

Polishes, Metal
Hoffman, Geo. W.

Presses, Hydraulic Wheel
(See Machine Tools.)

Printers
(See Tickets & Tranfers.)

Pulleys, Non-Metal
Rockwood Mfg. Co.

Pumps
(See also Condensers.)
Alberger Condenser Co.
Allis-Chalmers Co.
Blake Steam Pump Co., W. H.
*Borsig, A.
Deming Co., The.
Fairbanks, Morse & Co.
General Electric Co.
Laidlaw-Dunn-Gordon Co.
Watson Machine Co.
*Weir, G. & J.
Wheeler Condenser & Engineering Co.

Punches, Ticket
American Railway Supply Co.
Fairbanks, Morse & Co.
Garton, W. R., Co.
International Register Co.
Meyers, Fred. J., Mfg. Co.
Porter & Berg.
Recording Fare Register Co.
Sayre & Co., L. A.
Woodman Mfg. & Supply Co., The R.

Purifiers, Feed Water
(See Heaters and Purifiers.)

Pushers, Car
Atlas Railway Supply Co.
Woodman Mfg. & Supply Co. The R.

RETRIEVERS

The "EARLL" is in a class by itself.
It is simple and positive. Try it.

We are exclusive territorial agents also for Cameron Commutators and Segments and many other specialties.

STUART-HOWLAND CO., BOSTON

SHELBY TROLLEY POLES

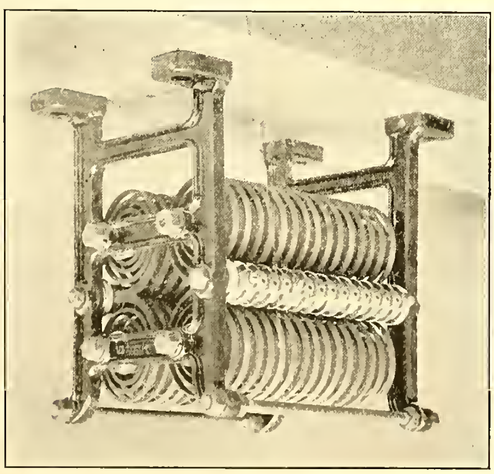
Made from cold drawn seamless tubing. Each pole is tested by suspending, 12 feet from butt end, a weight of 40 pounds, which must not produce a deflection in pole greater than 12 inches. After removal of weight, if pole does not return to its original shape, it is rejected. All standard lengths in stock.

GENERAL AGENTS FOR UNITED STATES AND CANADA

THE GARFORD CO., Elyria, O. Factories, Cleveland and Elyria

AGENTS: Watts & Uthoff Supply Co., St. Louis; John Millen & Sons, Montreal and Toronto; Frank Ridlon Co., Boston; Porter & Berg, Chicago; Western Electric Co., New York; Eccles & Smith Co., San Francisco.

Special Type of Ventilated Spiral Car Starting Resistance



New Features:

TERMINAL ON EVERY SPIRAL
WIDENED HUBS
GREATER RIGIDITY IN BOX
INCREASED DURABILITY

On this new form of resistance the following is the report of a test made by

Electrical Testing Laboratories

80th St. and East End Ave., New York, N. Y.

"No. 1 rheostat (B. Spirals, continuous current 80 amperes) showed a dull red color at the center after 6½ minutes.

"No. 2 (A. Spirals, continuous current 90 amperes) showed first color after 14 minutes."

Unless otherwise ordered rheostats of this special type will be assembled in boxes each containing 2½ ohms resistance.

Write for Prices

TRACTION EQUIPMENT CO. 74 Cortlandt St., NEW YORK

CLASSIFIED DIRECTORY—Continued.

Rails
(See Track Work.)

Rail Benders
(See Benders, Rail.)

Rail Bonds
(See Bonds, Rail.)

Rail Joints
(See Joints, Rail.)

Rail Welding
(See Joints, Rail.)

Rattan
Brill Co., J. G.
Hale & Kilburn Mfg. Co.
Heywood Bros. & Wakefield Co.
Mayer & Englund Co.
Ohio Brass Co.
Porter & Berg.
Stuart-Howland Co.

Registers and Register Fittings
Allison, Giles S.
Garton, W. R., Co.
General Railway Supply Co.
International Register Co.
Mayer & Englund Co.
Ohmer Fare Register Co.
Recording Fare Register Co.
Ridlon Co., Frank.
Security Register Co.
Sterling-Meaker Co.
StuartHowland Co.
Traction Equipment Co.
Woodman Mfg. & Supply Co., The R.

Repair Work
(See also Armature & Field Coils.)
American Gen'l Engineering Co.
Brill, J. G., Co.
Chattanooga Armature Works.
Cleveland Armature Works.
Columbia Machine Works & Malleable Iron Co.
Dittrick & Jordan Electric Co.
Dustin, Chas. E., Co.
Elliott Bros. Electric Co.
Jordan Electric Signal Co.
Ridlon, Frank, Co.
Rossiter, MacGovern & Co.
VanDorn-Elliott Electric Co.
Van Loan, I. S., Co.
Wickes Bros.

Replacers, Car
Garton, W. R., Co.
Kalamazoo Ry. Supply Co.
Traction Equipment Co.
U. S. Metal & Mfg. Co.

Reseating Machines
(See also Boiler Cleaners, Mechanical.)
Lagonda Mfg. Co., The.

Resistances, Wire and Tube
General Electric Co.
Simplex Electric Heating Co.
Traction Equipment Co.
Westinghouse Elec. & Mfg. Co.

Retrievers, Trolley
(See Catchers and Retrievers, Trolley.)

Roller Coasters
Ingersoll Construction Co.

Roofing
Johns-Manville Co., H. W.
Standard Paint Co., The.

Sand Boxes (Including Pneumatic Sanders)
Brill Co., J. G.
DeWitt Sand Box Co.
Jewett Car Co.
Ohio Brass Co.
Porter & Berg.
Ridlon Co., Frank.
St. Louis Car Co.
Sterling-Meaker Co.
Traction Equipment Co.

Sand Dryers
American Process Co.

Sash Fixtures
(See also Curtains.)
Edwards, O. M., Co.
National Lock Washer Co.

Saws, Rail
Railway Appliances Co.

Scrapers, Track
(See Cleaners & Scrapers, Track.)

Seating Materials
(See Curtains and Curtain Materials.)

Seats, Car
Brill Co., J. G.
Hale & Kilburn Mfg. Co.
Heywood Bros. & Wakefield Co.
*Peters, G. D., & Co.
St. Louis Car Co.

Separators, Oil and Steam
Harrison Safety Boiler Works.
Hoppes Mfg. Co.

Shoes, Brake
(See Brake Shoes.)

Shovels, Power
Allis-Chalmers Co.
Vulcan Iron Works Co.

Shutters, Steel Rolling
(See Doors, Steel Rolling.)

Signal Systems
Blake Signal & Mfg. Co.
*Dixon, S., & Sons, Ltd.
Eureka Automatic Electric Signal Co.
Jordan Electric Signal Co.
United States Electric Signal Co.

Signs, Car and Track
Creaghead Engineering Co.
Columbia Machine Works & Malleable Iron Co.
Porter & Berg.
Traction Equipment Co.
Wesco Supply Co.

Signs, Flashing
Haller Machine Co.

Skates, Roller and Ice
Henley, M. C.
Richardson Ball Bearing Skate Co.
Union Hardware Co.
Winslow, Sam'l, Skate Mfg. Co.

Skylights
Rendle, Arthur E.

Sleet Cutters
Garton, W. R., Co.
Porter & Berg.

Sleeves for Poles
(See Poles, Metal, Protected Sleeve for.)

Sleeving
(See Tapes & Cloths.)

Slot Machines
American Mutoscope & Biograph Co.
National Phonograph Co.

Smokestacks
(See Chimneys.)

Snowplows and Sweepers
Brill Co., J. G.
Consolidated Car Fender Co.
Dorner Mfg. Co., The.
*Mountain & Gibson, Ltd.
Morris, Elmer P.
Wesco Supply Co.

Soaps
(See Cleaning Powders and Washes.)

Speed Indicators
Woodman, R., Mfg. & Supply Co.

Splicing Sleeves
(See Clamps and Connectors for Wires and Cables.)

Sprinklers, Fire
(See Fire Extinguishers.)

Sprinklers, Track and Road
Brill Co., J. G.
Morris, Elmer P.
*Mountain & Gibson, Ltd.

Springs, Car and Truck
Brill Co., J. G.
Long, E. G.
Morris, Elmer P.
Railway Steel Spring Co.
Standard Steel Works.
Taylor Electric Truck Co.
Union Spring & Mfg. Co.

Steps, Car
Brill Co., J. G.
Railway Appliances Co.

CLASSIFIED DIRECTORY—Continued

Stock Guards
American Bridge Co.
Climax Stock Guard Co.
Cook's Railway Appliance Co.
Fairbanks, Morse & Co.
Kalamazoo Railway Supply Co.

Stokers, Mechanical
Babcock & Wilcox Co., The.
*Babcock & Wilcox, Ltd.
Green Engineering Co.
Murphy Iron Works.
Westinghouse Machine Co.

Storage Batteries
(See Batteries.)

Superheaters
Babcock & Wilcox Co., The.
Parker Boiler Co.
Power Specialty Co.

Strips, Protecting
(See Paving Materials.)

Structural Iron Work
(See Bridges and Buildings.)

Sweepers, Snow
(See Snow Plows and Sweepers.)

Switch Locks
Blanchard Railway Switch Lock Co.

Switches and Switchboards
Anderson Mfg. Co., Albert & J. M.
*British Thomson-Houston Co.
*British Westinghouse Electric & Mfg. Co.
*Brush Electrical Engineering Co.
Consolidated Car Heating Co.
Cutter Electrical & Mfg. Co.
General Electric Co.
*Maschinenfabrik Oerlikon.
*Nalder Bros. & Thompson.
Ohio Brass Co., The.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

Switchboard Mats
Massachusetts Chemical Co.

Switches, Track
(See Track Work.)

Sub-Station, Portable
(See Cars, Portable Sub-Station.)

Tapes and Cloths
(See also Insulating Tapes.)
American Gen'l Engineering Co.
Harrison, F. P., Electric & Mfg. Co., Inc.
Johns-Manville Co., H. W.
Hope Webbing Co.

Telephones
Mayer & Englund Co.
Stuart-Howland Co.
Wesco Supply Co.
Wire Telephone Co. of America.

Testing Instruments
(See Instruments, Electrical Measuring; Bond Testers.)

Third-Rail Insulators
(See Insulators, Third Rail.)

Tickets and Transfers
(Also Ticket Boxes and Cases.)
American Railway Supply Co.
Kinkead-Gillespie Co.
Ohmer Fare Register Co.
Stromberg, Allen & Co.

Ticket Choppers and Destroyers
Patten, Paul B.

Ticket Punches
(See Punches, Ticket.)

Ties
(See Poles and Ties.)

Tie Plates and Braces
(See Track Work.)

Timber Preserving Machinery
Allis-Chalmers Co.
Power & Mining Machinery Co.

Tools, Machine
(See Machine Tools.)

Tools, Track and Miscellaneous
(See also Grinders.)
American Gen'l Engineering Co.
Bissell Co., The F.
Brown, Harold P.
Fairbanks, Morse & Co.
Ohio Brass Co.
Underwood, H. B., & Co.

Torches
Macleod, Walter, & Co.

Tower Wagons
(See Wagons, Tower.)

Towers, Cooling
(See also Condensers.)
Alberger Condenser Co.
Wheeler Condenser & Engineering Co.
Worthington, Henry R.

Track Work
Alabama Frog & Switch Co.
American Bridge Co.
American Frog & Switch Co.
Atlas Railway Supply Co.
Barbour-Stockwell Co.
Beaver Dam Malleable Iron Co.
Cleveland Frog & Crossing Co., The.
*Dixon, S., & Sons, Ltd.
Falk Co., The.
Indianapolis Switch & Frog Co.
Lorain Steel Co.
New York Switch & Crossing Co.
Weir Frog Co.
Wharton, Wm., Jr., & Co., Inc.
Woolley Electric Co.

Transfers
(See Tickets and Transfers.)

Transfer Issuing Machines
Ohmer Fare Register Co.

Transformers
Allis-Chalmers Co.
Bissell, F., Co.
General Electric Co.
National Electric Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

Trap Doors
Edwards, O. M., Co.

Traps, Steam
American Blower Co.
Sturtevant Co., B. F.

Trolley Bases, Poles, Harps and Wheels
(See Bases, Poles, Harps and Wheels, Trolley.)

CLASSIFIED DIRECTORY—Continued.

Trolley Wagons
(See Wagons, Tower.)

Trucks, Car
American Car & Foundry Co.
American Car Co.
Baldwin Locomotive Works.
Brill Co., J. G.
Burnham, Williams & Co.
Dorner Mfg. Co.
Hammond, J., & Co.
Hanna, J. A., Co.
Laconia Car Co. Works.
Long, E. G.
Morris, Elmer P.
*Mountain & Gibson, Ltd.
Niles Car & Mfg. Co.
Stephenson Co., John.
Taylor Electric Truck Co.

Truing Devices, Commutator
(See Commutator Compounds and Truing Devices.)

Trust Companies
American Loan & Trust Co.
U. S. Mortgage & Trust Co.

Turbines, Hydraulic
(See Hydraulic Machinery.)

Turbines, Steam
Allis-Chalmers Co.
Ball & Wood Co.
General Electric Co.
Hooven-Owens-Rentschler Co.
Westinghouse Machine Co., The.

Vacuum Impregnating Apparatus
Devine, Jos. P.

Valves and Gates
Crane Co.

Variable Speed Motors
(See Motors, Electric.)

Varnishes
(See Paints & Varnishes.)

Ventilating Apparatus
(See Heating and Ventilating Apparatus.)

Vestibules, Portable
Brill Co., J. G.
Sjoberg & Co., J. P.

Voltmeters
(See Instruments, Electrical Measuring.)

Wagons, Tower
Kalamazoo Railway Supply Co.
Leonhardt Wagon Mfg. Co.
McCardell & Co., J. R.

Water Softening Apparatus
(See Boiler Cleaning Compounds.)

Water Wheels and Governors
(See Hydraulic Machinery.)

Wattmeters
(See Instruments, Electrical Measuring.)

Wheelbarrows
Fairbanks, Morse & Co.

Wheel Grinders
(See Wheel Truing Brake Shoe, under Brake Shoes; also Machine Tools.)

Wheel Guards
(See Fenders and Wheel Guards.)

Wheels and Axles
American Car & Foundry Co.
Brill Co., J. G.
Laconia Car Co.
Long, E. G.
Railway Steel Spring Co.
Standard Steel Works
Woodworth-Engert Co

Wheel Presses
(See "Machine Tools")

Wheels and Bushings, Trolley
Garton, W. R., Co.
Harrison, F. P., Electric & Mfg. Co., Inc.
Johns-Manville Co., H. W.
Morris, Elmer P.
*Mountain & Gibson, Ltd.
Nuttall Co., R. D.
Newell, J. F., & Co.
Recording Fare Register Co., The
Star Brass Works, The.
Wesco Supply Co.

Winding Machines
(See Armature and Field Coils.)

Wires and Cables
American Electrical Works.
Bissell, F., Co.
Bridgeport Brass Co.
D. & W. Fuse Co.
Eastern Electric Cable & Wire Co.
Electric Cable Co.
Garton, W. R., Co.
General Electric Co.
Magnet Wire Co., The.
McLeer Engineering Co.
National Conduit & Cable Co.
Okonite Co., The.
Pittsburg Reduction Co.
Porter & Berg.
Roebling's Sons Co., John A
Standard Underground Cable Co.
Waterbury & Co.
*Wire & Cable Co.
Wire & Telephone Co. of America.

Wire Connectors
(See Clamps and Connectors.)

Woodwork, Car
(See Vestibules, Doors, etc.)

Woodworking Machinery
American Woodworking Machinery Co.
Fay & Egan Co., J. A.

Wrenches, Automatic
Bullard Automatic Wrench Co.

THERE'S A

clear track and no speed ordinance

on the road to summer profits by way of the attractive park.

Moving Pictures

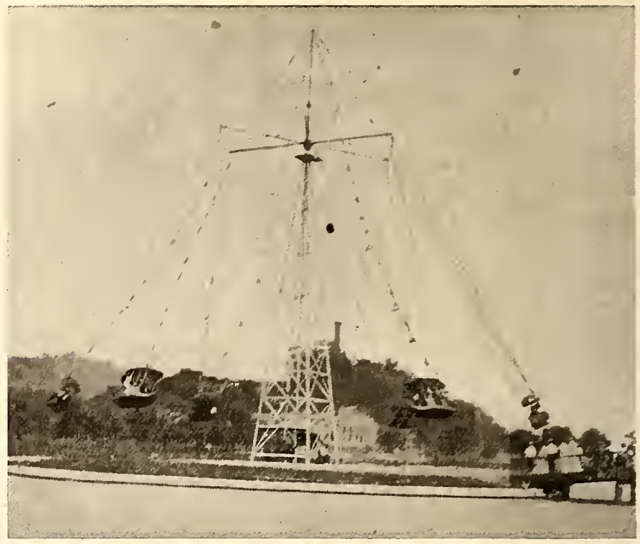
make parks attractive and, on our film rental basis, make parks profitable at a ridiculously low expenditure.

We furnish the very best and latest films culled from the world's supply. There's no other service to equal ours, and we'll guarantee it. We produce results. Try us.

MILES BROS.

10 East 14th Street, New York City

1139 Market Street, San Francisco



All Machinery in our Circle Swing is located inside the base of tower in constant view of the engineer, which prevents any possibility of bearings becoming hot or gears dry, which so often happens if gears are at the top of the tower. Main gears are of cast steel, which is a guarantee against breakage and disaster.

The **Main Shaft** carries the entire weight and revolves upon a pivoted base, thus requiring less power and giving easier motion than if gears were located at top and the weight carried on the tower. The main shaft and couplings are of cast steel and of extra strength, eliminating any chance of accident.

The Traver Circle Swing is a **Perfect and Mechanical** Amusement Device, and is always **Absolutely Safe,** simple in construction and smooth in operation. It is the Greatest Park Attraction, Safest Riding Device and the Greatest Money Earner in proportion to cost. We build Swings for sale or on concession, and have two or three very attractive concessions now on hand for outside buyers if desired. If you will tell us your needs we will meet them.

Do not be Deceived in Cut Prices, but Write Us.

Traver Circle Swing Co.

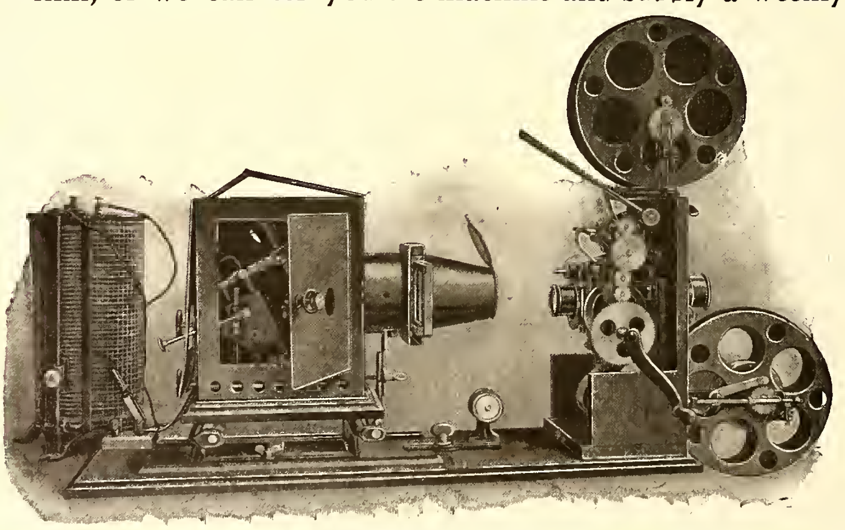
R. S. UZZELL, Treas. 66 BROADWAY, NEW YORK

A 65 per cent. Increase in Earnings

Of one road followed the installation of a Kinetograph in the Railroad Park

The Kinetograph is the king of moving picture machines, and by our system can be installed anywhere at a nominal cost, no advance outlay being required.

We can furnish you with a Kinetograph outfit, an operator and a weekly change of film, or we can sell you the machine and supply a weekly change of film upon an attractive rental basis. These machines can be operated by any park employee of average intelligence.



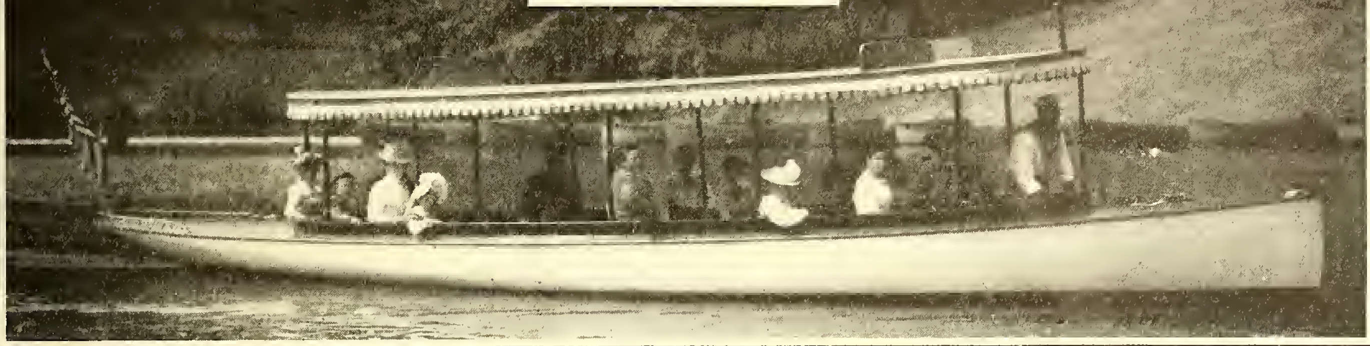
We are agents for machines and films made by the Edison Mfg. Co., now used in many parks. Write for our attractive proposition now and be ready for the warm weather crowds. . . .

The Kinetograph Co.

41 East Twenty-first St.

NEW YORK

Elco
MOTOR BOATS



AT TEN CENTS A HEAD THERE'S MONEY IN IT

Several 30-foot Electric Passenger Launches on hand for prompt delivery at special prices.

ELECTRIC LAUNCHES MAKE PAYING PARKS

NO DANGER OF FIRE OR EXPLOSION

LOW COST OF OPERATION

SEND FOR 1906 CATALOGUE

The Electric Launch Co., Bayonne City, N. J.

VITAGRAPH

MOVING PICTURES DE-LUXE

THE ATTRACTION OF ALL ATTRACTIONS FOR STREET RAILWAY PARKS

VITAGRAPH FILMS

12 CENTS PER FOOT

THRILLING! REALISTIC! SENSATIONAL!

These Great Subjects Draw the Crowds

THE ESCAPE FROM SING SING

RAFFLES, The Amateur Cracksman

SHERLOCK HOLMES, or Held for Ransom

MAN WITH THE LADDER AND THE HOSE, Greatest Fire Spectacle

THE GREEN GOODS MEN, Great Comedy Chase

OLIVER TWIST, or The Life of a Pickpocket

HUNDREDS OF OTHER BIG WINNERS

IF YOU WANT TO BUY
IF YOU WANT TO HIRE
IF YOU WANT THE BEST

WRITE US

The VITAGRAPH COMPANY of AMERICA

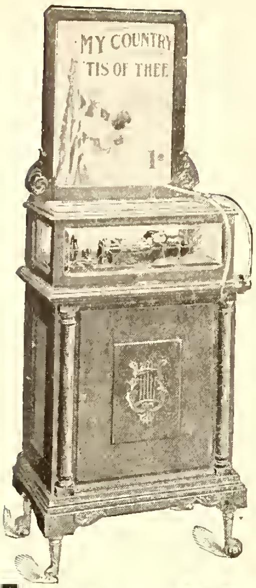
Telephone, 2764 John — 116 Nassau Street, New York — *Cable Address "Vitagraph"*

SELLING AGENTS:

KLEINE OPTICAL CO. 52 State Street, Chicago, Ill.

CHAS. URBAN TRADING CO., Ltd. 48 Rupert Street, London, England

MILES BROS. 116 Turk Street, San Francisco, Cal.



The Surest Payer
for
Railway Parks

The one never-failing, always new attraction that draws the crowd is one or more

EDISON COIN-SLOT PHONOGRAPHS

Start with one and you'll soon put in all your space will hold. Every successful "Penny Vaudeville" is based on these big payers, as investigation will prove. Each machine quickly pays for itself, as earnings are rapid and expense of operation small.

Write for Coin-Slot Phonograph Booklet

NATIONAL PHONOGRAPH CO.
68 LAKESIDE AVE., ORANGE, N. J.
New York, 31 Union Sq. Chicago, 304 Wabash Ave.

PARK ATTRACTIONS

A Full Line of

MERRY-GO ROUNDS
MINIATURE RAILWAYS
RAZZLE-DAZZLES
STRIKING MACHINES
AFRICAN DODGERS
THE OLD WOMAN
HOUSE FRONT DOLL
RACKS, &c.
AMUSEMENT OUTFITTERS

Write us for particulars

HERSCHELL-SPILLMAN CO.
North Tonawanda, N. Y., U. S. A.

B. F. Keith's International Circuit Vaudeville Theatres

SUMMER PARK DEPARTMENT
Managers of Summer Parks and Superintendents of Street Railroads can secure any and all kinds of Vaudeville material.

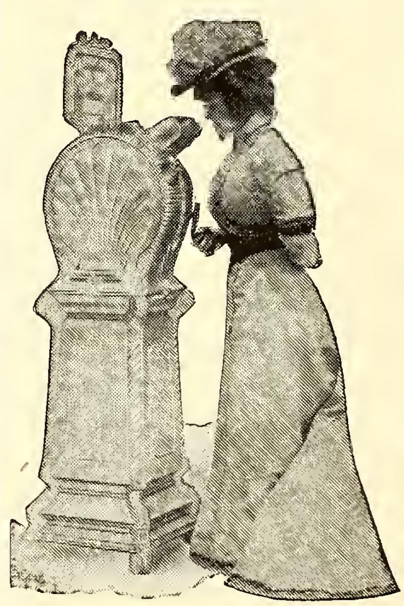
Outdoor Attractions
Animal Acts
Circus Acts

We will take entire charge of the bookings, and guarantee the merits of the performances. Full information furnished on application. The Park Circuit will be included in bookings of the regular theatre circuit, and the same careful attention will be paid to them.

For all information address
J. K. BURKE
Booking Manager Park Department
B. F. KEITH'S BOOKING OFFICES
823 to 828 St. James Bldg., B'way, cor. 26th St., New York City

ONE CENT VAUDEVILLE

A BONANZA FOR RAILWAY PARKS



The marvellous growth of the Penny Vaudeville business is well known. No first-class Park is now without its arcade, and we have figures a'plenty to prove that for the amount of investment required there is no more profitable attraction available. Up-to-date managers know that **it pays to own the machines.** You can buy an outfit for what you pay in one season's percentage. The backbone of the business is the

Mutoscope

We have an especially attractive proposition for Summer Parks Let us tell you about it.

AMERICAN MUTOSCOPE & BIOGRAPH CO.
(MUTO. DEPT.)
No. 11 East 14th Street, New York City

EDITION OF 1906 IN PREPARATION

The Electric Traction

"RED BOOK"

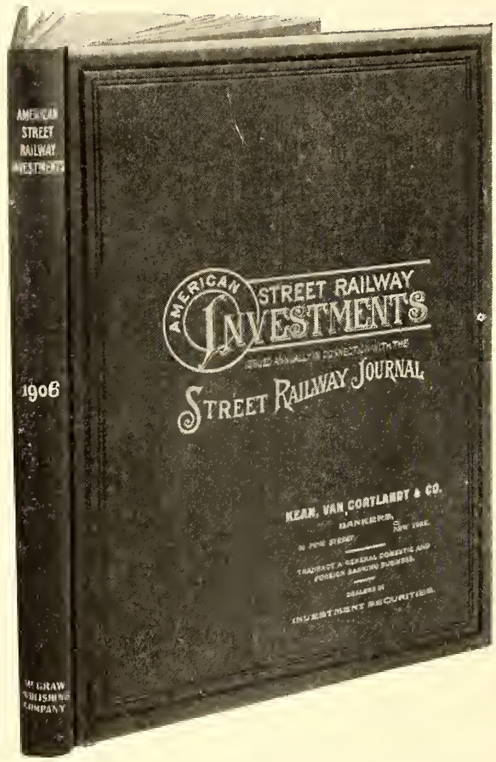
American Street Railway Investments

PUBLISHED ANNUALLY IN MAY

Subscription Price

(Including the "Red Book," published annually in May, and the Electric Railway Directory and Buyers' Manual, published in August, November and January.)

$5.00 per Annum



Combination Rate

The "Red Book" and Directory issues in combination with the Street Railway Journal (52 issues.)

$6.50 per Annum

SUBSCRIBERS

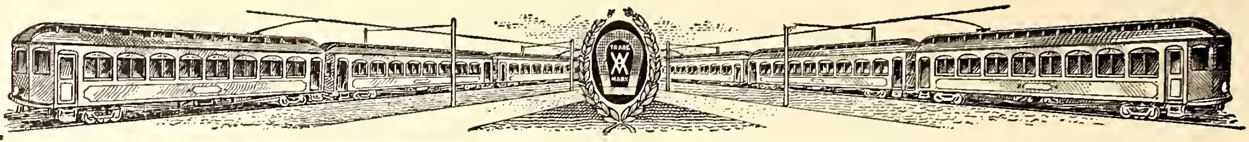
for the "RED BOOK" include electric railway officials and engineers, bankers, brokers, trust companies, investors, contractors and manufacturers. They find it not only the most complete and reliable financial manual in this field, but also the handiest for quick reference, on account of the alphabetical arrangement of companies by states and cities, the convenient and logical system of sub-headings, and the complete alphabetical index.

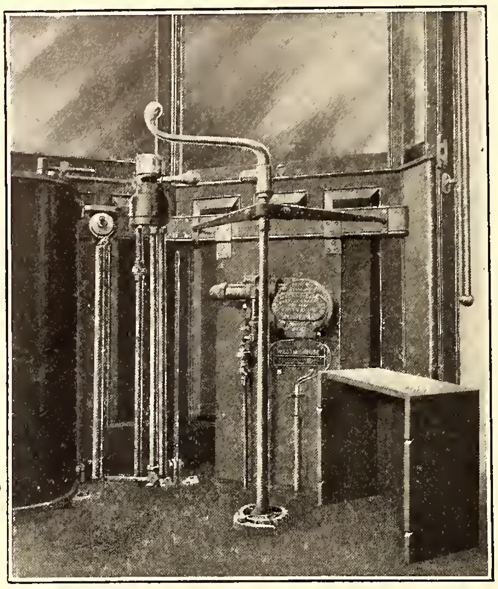
ADVERTISERS

in the "RED BOOK" include bankers and financial houses who wish to become known as dealing in traction securities; engineers and contractors who make a specialty of electric railway work; and manufacturers and supply dealers seeking business in this field. There is no publication so generally consulted by investors and others interested in electric railway securities as "AMERICAN STREET RAILWAY INVESTMENTS."

Send for Sample Pages

STREET RAILWAY JOURNAL, 114 Liberty Street NEW YORK





Westinghouse

Air Brakes for Electric Railways

Their absolute reliability is firmly established by years of the hardest kind of service and is further attested by their universal adoption on steam railways.

The illustration shows arrangement of controlling apparatus in cab of car equipped with Westinghouse Straight Air Brakes.

Westinghouse Traction Brake Co.

General Offices: Pittsburg, Pa.

Address nearest office for particulars

Boston, 638 Exchange Bldg.
Buffalo, 774 Ellicott Sq. Bldg.
Chicago, 1545 Ry. Exchange Bldg.
Cincinnati, 1111 Traction Bldg.
Cleveland, 1007 New Eng. Bldg.
Columbus, 1132 Col. Sav. & Trust Bldg.
Denver, 604 Majestic Bldg.
Los Angeles, 527 S. Main St.
Mex. City, Mex., 4½ Calle de San Diego.
New York, 2014 Trinity Bldg.
Richmond, 804 Amer. Natl. Bank Bldg.
San Francisco, 302 Rialto Bldg.
St. Louis, 1932 North Broadway.
St. Paul, 634 Endicott Bldg.
For Canada: Canadian Westinghouse Co., Limited, Hamilton, Ontario.

Apparatus Manufactured by the Westinghouse Air Brake Co.

Baldwin-Westinghouse

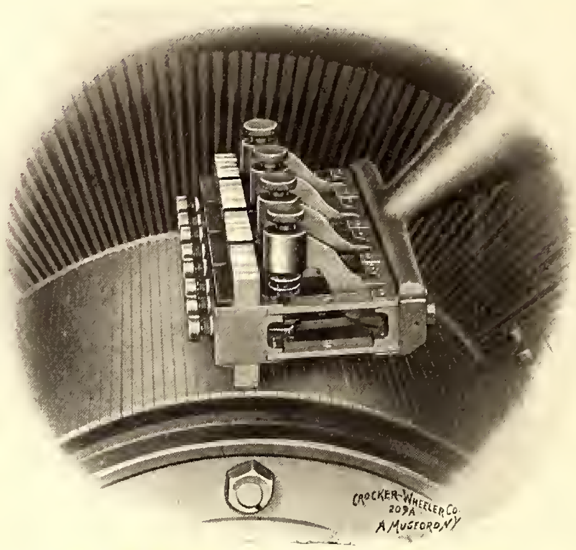
Electric Locomotives for Surface Haulage

Have established an enviable record for reliability of service, and low cost of maintenance and repairs.

Write either Company for Circular B-W 1000; it gives particulars.

Baldwin Locomotive Works
Philadelphia, Pa.

Westinghouse Electric & Mfg. Co.
Pittsburg, Pa.



The C-W Parallel Movement Brush Holders

THE SOURCE OF MOST

GENERATOR TROUBLES

is at the Brush Holders.

Recognizing this fact years ago, we experimented and investigated, perfecting the celebrated C-W Parallel Movement Brush Holder. This is but one of the many important features embodied in our generators which make them the

Ideal Street Railway Generators

Fully described in Bulletin No. 52 X.

CROCKER-WHEELER COMPANY

AMPERE, N. J.

Steam Power Plants

THEIR DESIGN AND CONSTRUCTION

By HENRY C. MEYER, Jr.

Cloth. 165 Pages. 63 Illustrations. 15 Plates. Price, $2.00

CHAPTER I.—Design of Steam Power Plants. II.—Proportioning Steam Boilers. III.—Desgin of Tubular Boilers and Boiler Specifications. IV.—Selection of Types of Engines. V.—Specifications for Steam Engines. VI.—Steam and Water Piping. VII.—Condensers. VIII.—Feed-Water Heaters and Economizers. IX.—Mechanical Draft. X.—Chimneys. XI.—Coal Handling Water Supply and Purification.

McGRAW PUBLISHING COMPANY
114 LIBERTY STREET NEW YORK

For the Construction and Repair of Dynamos, Motors, etc., only the Best Tapes and Webbings should be used. The best is always assured if you purchase Hope Tapes and Webbings.

Write for Samples and Prices.

Hope Webbing Co.
Providence, R. I.

HOPE TAPES AND WEBBINGS

I=T=E Circuit Breakers, for heavy Street Railway work, are the best obtainable.

Write for book, "Modern Circuit Breaker Practice"

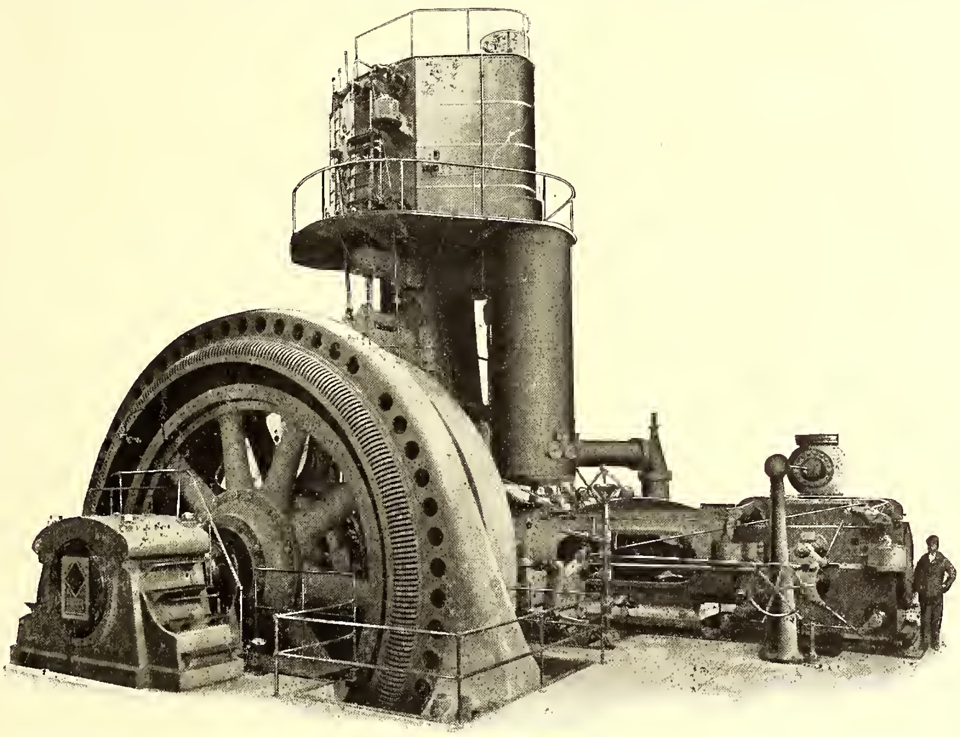
THE CUTTER CO.

PHILADELPHIA

ALLIS-CHALMERS CO
MILWAUKEE WIS U S A

The Strongest Guaranty of Future Efficiency is Satisfactory Performance in the Past

WHERE CAN YOU FIND MACHINERY WITH A BETTER RECORD THAN THAT MANUFACTURED BY THE ALLIS-CHALMERS CO.?



Reynolds Horizontal-Vertical Engine (Embodying Latest Patents) Direct Connected to A. C. Generator
Complete Unit – 3500 K. W. Capacity—Designed and Built by the Allis-Chalmers Co.

DETERMINE WHAT TYPE OF PRIME MOVER IS BEST ADAPTED TO YOUR NEEDS

Steam Turbine—Reciprocating Steam Engine—Hydraulic Turbine—Gas Engine

WE WILL BUILD FOR YOU THE COMPLETE GENERATING UNIT

Especially Designed to Meet the Required Conditions of Service

AND FURNISH ALL AUXILIARY ELECTRICAL EQUIPMENT

Including Motor Generator Sets, Transformers, Rotary Converters, Motors, Controllers, Etc.

DISTRICT OFFICES

ATLANTA, Ga., Fourth Nat'l Bank Bldg.
BALTIMORE, Md., Continental Bldg.
BOSTON, Mass., State Mutual Bldg.
BUFFALO, N. Y., Ellicott Square Bldg.
BUTTE, Mont., 51 East Broadway
CHICAGO, Ill., First Nat'l Bank Bldg.
CINCINNATI, O., First Nat'l Bank Bldg.
CLEVELAND, O., New England Bldg.
DALLAS, Texas, Wilson Building
DEADWOOD, S. D.
DENVER, Col., 1651 Tremont St.
DETROIT, Mich., 800 Union Trust Bldg.
EL PASO, Texas, Orndorff Hotel Bldg.
KANSAS CITY, Mo., The Dwight Bldg., corner Baltimore Ave. and Tenth St.
MINNEAPOLIS, Minn., Corn Ex. Bldg.
NEW YORK, 71 Broadway
OMAHA, Neb., 537 Ramge Bldg.
PHILADELPHIA, Pa., Land Title Bldg.
PITTSBURG, Pa., Frick Bldg.
ST. LOUIS, Mo., Chemical Bldg.
SALT LAKE CITY, Utah, Dooly Bldg., 117-119 West 2nd South St.
SAN FRANCISCO, Cal., Rialto Bldg.
SEATTLE, Wash., 316 Occidental Ave.
SCRANTON Pa

FOREIGN SALES OFFICES

LONDON - - - - - - - - 533 Salisbury House, Finsbury Circus, E. C.
JOHANNESBURG, South Africa - - - - - - - - The Corner House

FOREIGN SALES AGENCIES

AUCKLAND, New Zealand - - - - - - - John Chambers & Son, Ltd.
BUENOS AIRES - - - - - - - - - - - - - - Donnell & Palmer
CONSTANTINOPLE, Turkey - - - - - - - - - - J. G. Johnson & Co.
JOHANNESBURG, South Africa, Herbert Ainsworth (for Rock Crushers Only)
LIMA, Peru - - - - - - - - - - - - - - - - Henry Guyer
MANILA, P. I. - - - - - - - - - - - - - - Bryan-Landon Co.
MELBOURNE, Australia - - - - - - - Knox, Schlapp & Co., Propy. Ltd.
PERTH, West Australia - - - - - - - - - - - - Frank R. Perrot
VALPARAISO, Chile - - - - - - - - - - - - - - John R. Beaver
YOKOHAMA and KOBE, Japan - - - The American Trading Company
SHANGHAI, China - - - - - - - - - - The American Trading Company

Canadian Representatives, Allis-Chalmers-Bullock, Ltd., Montreal

CERTIFICATE OF No 211 CIRCULATION.

ASSOCIATION OF AMERICAN ADVERTISERS

This Certifies that this Association has examined the circulation of the **Street Railway Journal, New York,**

covering a period beginning with the seventh day of January Nineteen hundred and five and ending with the thirtieth day of December Nineteen hundred and five verifying the same from the press-room, books of record and system of distribution, and finds that the average number of copies of each issue circulated during said period was eight thousand one hundred and sixty (8,160) each week,

according to the definition of circulation adopted by this Association.

ASSOCIATION OF AMERICAN ADVERTISERS

This Certificate is valid only in its entirety

Dated, New York: March 10, 1906.

Chas. W. Cheney
PRESIDENT

Bert M. Moses,
SECRETARY

H. H. Kramer
CHAIRMAN, COMMITTEE ON CIRCULATIONS

DIRECTORY OF STREET RAILWAY ASSOCIATIONS

American Street & Interurban Railway Association.

President, W. Caryl Ely, Ellicott Sq., Buffalo, N. Y.
First Vice-President, John I. Beggs, President and General Manager Milwaukee Elec. Ry. & Lt. Co., Milwaukee, Wis.
Second Vice-President, Calvin G. Goodrich, Vice-President and Managing Director Twin City Rapid Transit Company, Minneapolis, Minn.
Third Vice-President, James F. Shaw, President Boston & Worcester Electric Co., Boston, Mass.
Secretary and Treasurer, B. V. Swenson, 60 Wall St., New York City.
Executive Committee: Presidents and Vice-Presidents and H. H. Adams, President American Street & Interurban Railway Engineering Association; S. L. Rhodes, President American Association of Street Railway Claim Agents; W. B. Brockway, President American Street & Interurban Railway Accountants' Association.

American Street and Interurban Railway Accountants' Association.

President, W. B. Brockway, General Auditor Nashville Railway & Light Company, Park Hill, Yonkers, N. Y.
First Vice-President, P. S. Young, Comptroller Public Service Corporation of New Jersey, Newark, N. J.
Second Vice-President Robert N. Wallis, Treasurer Fitchburg & Leominster Street Railway Co., Fitchburg, Mass.
Third Vice-President, H. A. Ferrandou, Auditor and Treasurer New Orleans Railway & Light Co., New Orleans, La.
Secretary and Treasurer, Elmer M. White Assistant Treasurer Birmingham Railway, Light & Power Co., Birmingham, Ala.
Executive Committee: William G. Ross, Managing Director Montreal Street Railway Co., Montreal, Can.; C. L. S. Tingley, Second Vice-President American Railways Co., Philadelphia, Pa.; F. Dabney, Assistant Treasurer Seattle Electric Co., Seattle, Wash.; E. F. J. Gaynor, Auditor, Interborough Rapid Transit Co., New York.

American Association of Street Railway Claim Agents.

President, S. L Rhoads, Claim Agent, Philadelphia Rapid Transit Co., Philadelphia, Pa.
First Vice-President, E. W. O'Connor, Savannah, Ga.
Second Vice-President, Henry G. Bradley, Chicago Ill.
Third Vice-President, Andrew J. Farrell. Buffalo, N. Y.
Secretary and Treasurer, B. B. Davis, Columbus, O.
Executive Committee: The Officers and Wm. H. Renaud, Jr., New Orleans, La.; H. V. Drown, Providence, R. I.: James R. Pratt, Baltimore, Md.

American Street and Interurban Railway Engineering Association.

President, H. H. Adams, Master Mechanic United Railways & Electric Co., Carroll Park Shops, Baltimore, Md.
First Vice-President, F. G. Simmons, Superintendent of Way, Milwaukee Electric Railway & Light Co., Milwaukee, Wis.
Second Vice-President, J. S. Doyle, Master Mechanic Electrical Department, Interborough Rapid Transit Co, 98th St. and 3rd Ave., New York, N. Y.
Third Vice-President, Paul Winsor, Chief Engineer Motive Power and Rolling Stock, Boston Elevated Ry. Co., Boston, Mass.
Secretary and Treasurer, S. W. Mower, 12 Woodward Ave., Detroit, Mich.
Executive Committee: W. S. Twining, Chief Engineer Philadelphia Rapid Transit Co., Philadelphia, Pa.; Fred. N. Bushnell, Chief Engineer The Rhode Island Co., Providence, R. I.; W. Boardman Reed, Engineer Maintenance of Way and Buildings, New York City Ry. Co., New York, N. Y.; A. D. Campbell, Master Mechanic The Seattle Electric Co., Seattle, Wash

American Street Railway Manufacturers Association.

Executive Committee: E. H. Baker, Chairman, pro tem., Galena Signal Oil Co., 26 Broadway, New York City; John A. Brill, Vice-President J. G. Brill Co., Philadelphia, Pa.; Newcomb Carleton, Fourth Vice-President Westinghouse Electric & Manufacturing Co., Pittsburg, Pa.; E. M. Williams, Director Sherwin-Williams Co., Cleveland, O.; Fred S. Kenfield, President Kenfield Publishing Co., Chicago, Ill.; Geo. J. Kobusch, President St. Louis Car Co., St. Louis, Mo.; Charles C. Pierce, General Electric Co., Boston, Mass.; James H. McGraw, President McGraw Publishing Co., 114 Liberty street, New York, N. Y.; John W. Nute, President and Manager St. Louis Car Wheel Co., St. Louis, Mo.; Wm. Wharton, Jr., President Wm. Wharton, Jr. & Co., Inc., Philadelphia, Pa.; C. K. King, Secretary Ohio Brass Co., Mansfield, O.; Frank C. Randall, National Electric Co., Milwaukee, Wis.; Howard F. Martin, General Manager of Sales, Pennsylvania Steel Co., Philadelphia, Pa.; J. R. Ellicott, Westinghouse Traction Brake Co., New York City; Chas. Knickerbocker, Griffin Wheel Co., Chicago, Ill.
Secretary, George Keegan, 21 Park Row, New York, N. Y.

Canadian Street Railway Association.

President, W. G. Ross, Managing Director, Montreal Street Railway, Montreal, Que.
First Vice-President, W H. Moore, Assistant to the President, Toronto Railway Co., Toronto, Ont
Secretary and Treasurer, Allan H. Royce, 48 King St. W., Toronto, Ont.
Executive Committee: The President, Vice-President and C. E. A. Carr, General Manager, Secretary and Treasurer, London Street Railway Co.; E. A. Evans, Manager Quebec Ry., Light and Power Co.; D. McDonald, Manager, Montreal Street Railway Co.

Colorado Electric Light, Power and Railway Association.

President, F. W. Frueaff, Vice-President and Manager, The Denver Gas & Electric Co., Denver.
Vice-President, William Mayher, Treasurer The Greeley Power & Light Co., Greeley.
Secretary and Treasurer, George B. Tripp, General Manager The Colorado Springs Electric Co., Colorado Springs.

Central Electric Railway Association.

President, Edward C. Spring, General Manager, Dayton, Covington & Piqua Traction Co., West Milton, Ohio.
First Vice-President, Charles L Henry, President, Indianapolis & Cincinnati Traction Company, Indianapolis, Ind.
Second Vice-President, F. D. Carpenter, General Manager, Western Ohio Railway Co., Lima, Ohio.
Secretary, J. H. Merrill, Traction Terminal Building, Indianapolis.
Treasurer, W. F. Mulholland, Treasurer, Indianapolis Traction & Terminal Co., Indianapolis, Ind.
Executive Committee. F. J. Sloat, General Manager, Southern Ohio Traction Co., Hamilton, Ohio; Theodore Stebbins, General Manager, Columbus London & Springfield Ry. Co., Columbus, Ohio; Harrie P. Clegg, General Manager, Dayton & Troy Elec. Ry. Co., Dayton, Ohio; J. W. Brown. Superintendent Trans., West Penn Railways Co., Connellsville, Pa.; C. N. Wilcoxson, General Superintendent, Cleveland & Southwestern Ry. Co., Cleveland, Ohio; W. G. Irwin. General Manager, Indianapolis, Columbus & Southern Traction Co., Columbus, Ind.; C. D. Emmons, Supertindent, Ft. Wayne, Van Wirt & Lima Traction Co., Ft. Wayne, Ind.; Gardner Wells, Manager, Terre Haute Traction Co., Terre Haute, Ind.; C. C. Reynolds, General Manager, Indianapolis & Northwestern Traction Co., Lebanon, Ind.; H. A. Nicholl, General Manager Indiana Union Traction Co., Anderson, Ind. Meetings are held alternately in Ohio and Indiana every two months except during the summer.

Iowa Street & Interurban Railway Association.

President, George B. Hippee, General Manager, Des Moines City Railway Co., Des Moines.
Vice President J F Lardner, General Manager, Tri City Railway Co., Davenport.
Secretary and Treasurer, L. D. Mathes, General Manager, Union Electric Co., Dubuque.
Executive Committee: President, Vice-President and the Secretary and Treasurer.
Next meeting at Des Moines, April, 1906.

The Maine Street Railway Association.

Secretary and Treasurer, E. A. Newman, 471 Congress St., Portland.
Executive Committee: Amos F. Gerald, Waterville; J. Manchester Haynes, Augusta; G. E. Macomber, Rockland.

Massachusetts Street Railway Association.

President Edward P. Shaw, Newburyport.
First Vice-President, Francis H. Dewey Worcester.
Second Vice-President, Robt. S. Goff Fall River.
Secretary, Charles S. Clark, 70 Kilby St., Boston.
Treasurer, Fred H Smith, Quincy
Executive Committee. President, Vice-Presidents and P. F. Sullivan, Lowell; H. H. Crapo, New Bedford; William S. Loomis, Holyoke; W. W Sargent, Fitchburg; Wm. M. Butler, Boston.
Monthly meetings second Wednesday of each month excepting July and August.

New England Street Railway Association.

President, E. E. Potter, New Bedford, Mass.
Vice-Presidents for States: Geo. E. Macomber, Augusta, Me.; L. N. Wheelock, Claremont, N. H; A. J. Crosby, Springfield, Vt.; Paul Winsor, Boston, Mass.; J. E. Thielsen, Providence, R. I.; Norman McD. Crawford, Hartford, Conn.
Secretary, John J. Lane, Editor Street Railway Bulletin. 12 Pearl St. Boston Mass.
Treasurer, Nathan L. Wood, 246 Summer street, Boston, Mass.
Executive Committee: J. H. Neal, Boston, Mass.; H. E. Farrington, Chelsea, Mass.; W. D. Wright, Providence, R. I.; E. A. Sturgis, Worcester. Mass.; C. E. Sprague, Boston, Mass.; John E. Bradley, Worcester, Mass.; F. A. Barbey Boston, Mass.
Finance Committee: E. E. Potter, New Bedford, Mass.; James F. Wattles, Boston, Mass.; M. C. Brush, Newtonville, Mass.
Meetings are held the fourth Thursday of every month. Next annual meeting in March, 1906.

New York State Street Railway Association.

President, R. E. Danforth, General Manager Rochester Railway Company, Rochester, N. Y.
First Vice-President, B. B. Nostrand, Jr., President and General Manager Peekskill Lighting & Railroad Company, Peekskill, N. Y.
Second Vice-President, J. H. Pardee, General Manager and Purchasing Agent Rochester & Eastern Rapid Railway Company, Rochester, N.Y.
Secretary, C. B. Fairchild, Jr., Associate Editor, Street Railway Journal, New York, N. Y.
Treasurer, W. W. Cole, Vice-President and General Manager Elmira Water, Light & Railroad Company, Elmira, N. Y.
Executive Committee: Officers and E. F. Peck, General Manager Schenectady Railway Company, Schenectady, N. Y.; T. W. Wilson, General Manager International Railway Company, Buffalo, N Y.; Oren Root, Jr., General Manager New York City Railway Company; J. N. Shannahan, General Superintendent and Purchasing Agent Fonda, Johnstown & Gloversville Railroad Company, Gloversville, N. Y.

Pennsylvania State Street Railway Association.

President, F. B. Musser, Harrisburg.
Secretary, Charles H. Smith, Lebanon.
Treasurer, W. H. Lanius, York.
Executive Committee: The President Secretary, Treasurer and Ernest H. Davis, Williamsport, John A. Rigg, Philadelphia.

Southwestern Electrical & Gas Association.

(Consolidation of Southwestern Gas Electric & Street Railway Association and the Southwestern Electrical Association.)
President, M. M. Phinney, Dallas, Tex.
First Vice-President, J. W. McLendon, Fayetteville, Ark.
Second Vice-President, E. W. Dunaway, Paris, Tex.
Third Vice-President, J P. Crerar, Denison, Tex
Secretary, Frank J. Duffy, Beaumont, Tex.
Treasurer, A. E. Judge, Tyler Tex
Next meeting, Galveston, May 16-18, 1906.

Toronto (Canada) Railway Inspectors' Association.

President, E. Whitaker, Toronto.
Vice-President, Geo. A. Greene, Toronto.
Secretary and Treasurer, John F. Argue, Janes Building, King and Yonge Streets, Toronto.
Executive Committee: D. Kearhey, Louis Wheeler and F. M. Blight.
Executive Committee meets the first of each month.
Annual meeting in January.

Tramways and Light Railways Association of Great Britain.

President, Hon. Arthur Stanley, M. P.
Secretary, Ernest Benedict, M. Inst. C. E.
Offices, Clun House, Surrey Street, London, W. C., England.
Meetings are held monthly in London.

Union Internationale de Tramways et de Chemins de fer d'intérêt local.

President, Leon Janssen, Gen. Mgr. Société des Tramways Bruxellois, 6, Impasse du Parc, Brussels
Vice-Presidents Gustav Köhler, Berlin; E. A. Ziffer Vienna.
Secretary, M. T'Serstevens, 6, Impasse du Parc, Brussels.
Treasurer, F. Nonnenberg, Chief Engineer of the Compagnie des Chemins de fer Secondaires, Brussels.
Executive Committee: Officers and Messrs. Broca, Paris; Geron, Cologne; Kessels, Brussels; Von Pirch, Barmen-Elberfeld; Lavalard, Paris.
Next convention, Milan, Italy, September 1906


You can't be
safe without the
PEACOCK BRAKE
No other hand brake is fit for use on a modern electric car.
The Peacock gives perfect control—takes up slack chain quickly and gives great power. It works easily because the eccentrically geared spiral drum works on roller bearings. The chain can't kink or catch, there's nothing to wear unduly. Over 400 roads use it. Do you?
NATIONAL BRAKE COMPANY
680 and 682 Ellicott Square, BUFFALO, N. Y.
WIGMORE BROS. CO., Agents for Pacific Coast, Los Angeles, Cal.
ST. R'Y JOURNAL

SECOND HAND EQUIPMENT

ALTERNATING CURRENT APPARATUS

1,800 K.W. G. E. 3 ph., 25 cy. alternator d.c. Cooper Corliss cross compound engine.
500 K.W. Westinghouse 10,000 v. 3 ph., 60 cy. d.c. Buckeye tandem engine.
300 K.W. G. E. 3 ph., 60 cy., 2,300 v., d.c. McIntosh & Seymour engine.
300 K.W. Westinghouse 2 ph., 60 cy., 2,300 v. direct connected cross compound engine.
300 K.W. G. E. 3 ph., 2,300 v., 25 cy. belted alternator.
250 K.W. G. E. 3 ph., 10,000 v. alternator.
300 K.W. Stanley 2 ph., 60 cy. alternator.
250 K.W. Stanley 2 ph., 60 cy. alternator
100 K.W. G. E. 3 ph., 60 cy., 2,300 v. alternator.
75 H.P. G. E. 3 ph., 60 cy., 2,200 v. motor.

Send for Stock List of 125 Cycle Alternators.

500 to 550 VOLT APPARATUS

400 K.W. (2) G. E. generators direct connected Harrisburg tandem engines.
375 K.W. (2) Westinghouse generators direct connected Westinghouse engines.
225 K.W. G. E. generator direct connected Erie Ball vertical cross compound engine.
500 K.W. (2) Westinghouse 4 pole generators.
300 K.W. (2) General Electric 4 pole generators.
270 K.W. (2) General Electric 4 pole generators.
250 K.W. (2) Westinghouse 4 pole generators.
225 K.W. G. E. 6 pole generator.
225 K.W. (2) Crocker-Wheeler 4 pole generators.
200 K.W. Westinghouse 4 pole generator.
75 K.W. (2) G. E. 4 pole generators.

ENGINES AND BOILERS

Two Allis Triple Expansion engines, 24 and 40 and 56 x 60.
26 and 40 x 48 Allis cross compound engine.
24 and 48 x 48 Buckeye tandem engine.
24 and 44 x 60 Cooper Corliss engine.
20 and 30 x 24 Porter Allen automatic.
18½ and 31 x 16 Westinghouse compound engine.
17 and 28 x 16 (2) Harrisburg tandem engines.
24 x 18 Armington & Sims engine.
18½ x 18 (2) A. L. Ide automatic engines.
18 x 16 Westinghouse standard engine.
17 x 24 (2) Russell 4 valve engine.
14 x 14 Harrisburg Ideal engine.
Two batteries Abendroth & Root; two 500 H.P. boilers to the battery; 160 lbs. steam pressure.
Two 250 H.P. Sterling boilers in battery; 150 lbs. steam pressure.
5000 H.P. in B. & W. boilers; 150 lbs. steam pressure.
Two 400 H.P. Campbell & Zell; 150 lbs. steam pressure.

CARS AND MOTORS

Open and closed cars of every description. Send for complete list.
Forty-four G. E. 800 railway motors, 3 and 4 turn, No. 10 wire.
Four G. E. 1,200 railway motors.
Twelve Lorain No. 34 railway motors.
Sixteen Westinghouse 12-A railway motors.

Send for complete and new "Bargain List."

JOSEPH H. THOMPSON, Jr.
11 BROADWAY NEW YORK

FOR SALE

LOW PRICES PROMPT DELIVERY

Electrical Equipment

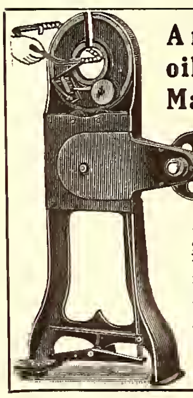
2 300 K.W. Westinghouse alternators.
1 200 K.W. Wood alternator.
4 120 K.W. General Electric alternators.
1 100 K.W. Westinghouse Railway generator.
1 75 K.W. General Electric D. C. generator.
2 70 K.W. Thompson-Houston alternators.

Boilers

1 350 H.P. Heine water tube.
1 300 H. P. Standard water tube.
1 287 H.P. Stirling water tube.
3 200 H.P. Wickes water tube.
3 150 H. P. Wickes water tube.
7 150 H.P. Wickes tubular, NEW.
11 60″ x 16′ tubular.
3 54″ x 15′ tubular.

Send for complete stock lists.

WICKES BROTHERS
SAGINAW, MICH.



Armature oil Taping Machine

Saves Time Labor and Money

A boy can tape 40 coils for Westinghouse 12A Armature in an hour. Further particulars gladly furnished

GEO. M. GRISWOLD
New Haven, Conn.

---

400 Second-hand Bridges
4 Tandem Rollers

NEW and SECOND-HAND
Steam Shovels, Concrete Mixers and Contractors' Equipment

Advance Equipment Co.
508 West End Trust Bldg., Phila., Pa.

FOR SALE CHEAP

69 Good Second Hand Bridges
22 New (D. P. G.) Bridges

Specifications and Blue Prints on application.

F. A. JOHANN
Equitable Bldg. ST. LOUIS, MO.

New 7″ Girder Rails

500 tons immediate delivery

Two 50 ton Mogul Locomotives fine condition

Walter A. Zelnicker Supply Co.
in ST. LOUIS

Get our Monthly Rail & Equipment List.

Attention! Purchasing Agents

Do not depend on railroads for carrying your coal at this time. We have Hopper and Flat Bottom Gondola Cars, 50,000 to 60,000 pounds. We can sell in lots to suit at moderate prices. Have you anything to dispose of?

34 and 36 Wall Street New York — **THE MALES CO.** — 713 Traction Bldg. Cincinnati, O.

WHEN WRITING to advertisers please mention the "Street Railway Journal."

WANTED--One Standard Gauge Express and Freight Car, with or without electrical equipment. Must be in good order.

Cincinnati & Columbus Traction Co.
Cincinnati, Ohio.

---

2 CARS FOR SALE

One closed; one open. Closed car, 12 ft. body; open car, 10 ft. body; cross seats. Both equipped with Meaker registers, and are in good order. Price, $300 for both cars. May be personally inspected by applying to station agent, Union Depot, Palatka, Fla.

WM. P. CRAIG
Orange, N. J.

FOR SALE

A modern power plant used less than two years.

1 22″ x 24″ Russell four-valve automatic engine.
2 66″ x 16′ boilers with full front and connecting breeching.
1 boiler feed pump, brass fitted.
1 steam separator and necessary connecting piping.

Will quote low prices to make sale before shipment to our warehouses.

WICKES BROTHERS
New York Pittsburg
Saginaw, Mich.

All Kinds of Construction Material at Low Prices

We own the Fifty Million Dollar St. Louis World's Fair. Ask for our Catalogue No 626.

CHICAGO HOUSE WRECKING CO.
35th and Iron Sts. Chicago

TROLLEY TIES and POLES
PROMPT SHIPMENTS

Cross Arms, Brackets and Pins

H. H. MAUS & CO.,
420 Walnut St., PHILADELPHIA, PA.

RAILS FOR SALE

Quick Shipment from Stock

30, 35, 40, 52, 56 and 60 lbs.

RELAYING RAILS

12, 16, 20, 25, 30, 35, 40, 65, 80, 90 and 100 lbs.

NEW STEEL RAILS

All these rails are ready for shipment as soon as cars can be placed, and we can quote low prices.
Please write, or wire us for quotations.
We also buy new and relaying rails of all sizes.

Iron City Steel Co.
Bessemer Building, PITTSBURGH, PA.

The point is just this! Are you dissatisfied with your present position—or have you an employee who is unsatisfactory? In either case, where could you better turn for relief than to a corps of trained employment experts? We have secured better positions for thousands of men, and have supplied thousands of employers with competent men. Why hesitate? Booklets can be secured for the asking. HAPGOODS, Suite 511, 309 Broadway, New York City.

POSITIONS WANTED

For advertisements under this heading the rate is $1.00 per insertion for 50 words or less, payable in advance; additional words 2 cents each.

POSITION WANTED by a practical man of large experience as superintendent of motive power of large electric light or power plant. Can furnish good references from past and present employer. Now employed but wish to make a change. Address "No. 558," care STREET RAILWAY JOURNAL.

A CIVIL ENGINEER, experienced in location and construction of interurban and high speed electric railways, is open for engagement. Am also experienced in the construction of high tension transmission lines. Best of references. Address, "Box 593," care of STREET RAILWAY JOURNAL.

WANTED—A position as General Manager of Electric Railway property. Applicant is now employed as Vice-President and General Manager. Large experience in city, suburban and interurban work both in the East and Middle West. Competent to take full charge of a property. Address, "Box 594," care of STREET RAILWAY JOURNAL.

WANTED—A well-rated Pittsburg Sales Agency, with good trade connections and acquaintances, are prepared to offer first-class sales representation, among manufacturers and dealers, throughout the Pittsburg territory, on a commission basis. Correspondence solicited. Address AGENT, Post Office Box 194, Allegheny, Pa.

WANTED—Position as superintendent of an electric railway system, or division superintendent of a large road. Have had 15 years' experience in street railway work, and for the last five years have been division superintendent of an important company. Can furnish best of references. Address "No. 595," care STREET RAILWAY JOURNAL.

WANTED—Position as manager or superintendent of an interurban railway, wanted by a man of experience and ability. At present superintendent of an important and successful system. Address "Box 596," care STREET RAILWAY JOURNAL.

POSITION WANTED—As electrical engineer or superintendent of railway or lighting company, by young man (28); 6 years' experience in lighting and railway work. Technical graduate, associate member A. I. E. E. Hard working, capable, an organizer, and with executive ability. Address "597," care STREET RAILWAY JOURNAL, New York.

WANTED—Young man familiar with organizing, constructing and operating city and suburban lines, desires position as manager of road now operated or proposed. Acquainted with details of building, securing franchises, and directing preliminary work. References furnished. Will go anywhere. Southwest preferred. Address "Box 599," care STREET RAILWAY JOURNAL.

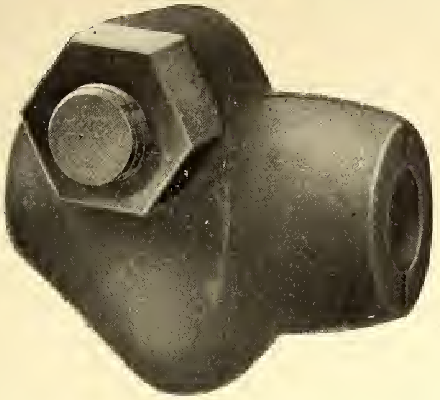
WANTED—Position as general manager of street railway in large city. Address "598," care STREET RAILWAY JOURNAL.

POSITION — As master mechanic, superintendent, foreman, track and overhead. Thoroughly understand winding armatures and field construction, operating and repairing. Seventeen years' experience, electric roads; last five years as superintendent; am competent handling men, know how to economize and work for the company's interest; 39 years of age, married; first-class references. Address "Box 600," care STREET RAILWAY JOURNAL.

FOR SALE AT A BARGAIN.

3-200 K. W. Westinghouse oil insulated, self-cooling, raising transformers, 390 to 6600 volts, 25 cycles, three phase, 300 alt., with 5% loops in secondary winding.
3-6600 volt, 100 ampere, low equivalent Westinghouse lightning arresters.
3 choke coils for 6600 volt, three phase, high potential fused type circuit breakers.
Above in first class condition, ready for immediate delivery.

National Machinery & Wrecking Co.
Cleveland, Ohio.



For use on curves

in transmission lines where there's likely to be excessive strain on a small area of the insulator, this Type A

Clark Ball-Socket Insulator Clamp

is ideal. It distributes the strain uniformly over a large area of insulator, and while holding the conductor firmly in position, transmits its motion from span to span, thus reducing bending strains.
Our bulletins describe this and other types. Have you a set?

The CLARK ELECTRIC AND MANUFACTURING COMPANY
26 CORTLANDT ST., NEW YORK

FOR SUPPORTING ELECTRIC LIGHT AND POWER CABLES

Think of the simplicity of the device! It can be clamped to the cable in five minutes. A block and tackle can be attached to the coupling bolt by means of a strain insulator and a guy wire, and the slack cable pulled up to the corner. Anchor this guy wire. The cable can now be easily bent around the pole to make the turn, and another clamp attached and anchored as before. The cable can then be stretched tight along the line away from the corner pole. This can all be done without the necessity of cutting the cable, the use of expensive splices, or the waste of time, labor and material necessary in these operations.

The KEARNEY CABLE CLAMP is not expensive. It is introduced on the same plan as is the Stombaugh Guy Anchor, viz., 25 or more will be shipped by prepaid freight on 30 days' trial. If satisfactory pay us for them—otherwise return them freight charges collect.

You may save money by accepting this proposition. You can't lose.

SEND FOR 1906 CATALOG. JUST OUT.

W. N. MATTHEWS & BRO.
217 N. 2d STREET — MANUFACTURERS — ST. LOUIS
EASTERN OFFICE: 227 TAYLOR BLDG., CORTLANDT ST., NEW YORK CITY

RAILWAY MOTORS

40 Westinghouse 49=35=H.P.
30 Westinghouse 38B=45=H.P.
8 Westinghouse 12A=30=H.P.
12 Westinghouse 56=50=H.P.
16 General Electric 1000=35=H.P.
22 General Electric 800=25=H.P.
6 General Electric 52=25=H.P.
32 Lorain No. 22 30=H.P.
4 Walker 50=H.P.
30 Walker 30=H.P.

These have been put through the shops, thoroughly over=hauled, cleaned, painted and tested. Actually in stock, and ready for immediate shipment.

OPEN CARS

22 10=bench Pullman, American and Lamokin.
28 9=bench Pullman and Brill.
36 8=bench St. Louis, Brill, Stephenson.
17 7=bench Brill and Jones.

Fully equipped, bodies only, or with trailer trucks.

Armatures, Controllers, Generators, Motors, Engines, Boilers, Pumps.

I. S. VAN LOAN CO.

78 E. 131st Street — 79 E. 130th Street
NEW YORK. N. Y.

When this frame broke

through lug and axle-box, as shown, what do you think they did with it? Scrap it? No sir! Patch it? No sir! It was restored with

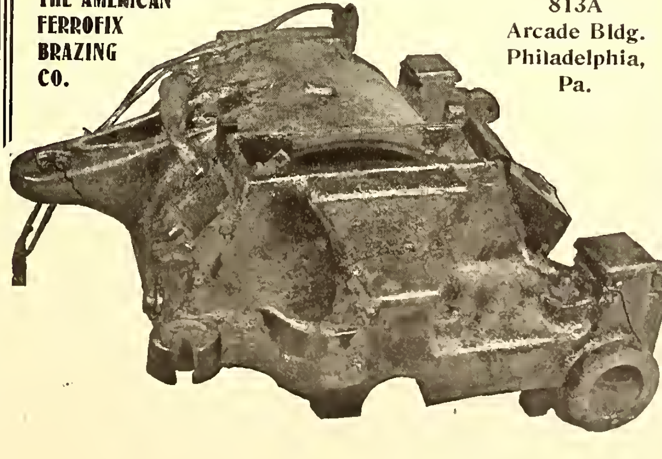
"FERROFIX"

which brazes fractured surfaces with a material stronger than the casting itself. Patches can also be brazed on solid, giving much additional strength where it may be needed. It's a permanent job and the casting is better than when new.

BETTER GET DETAILS

THE AMERICAN FERROFIX BRAZING CO.

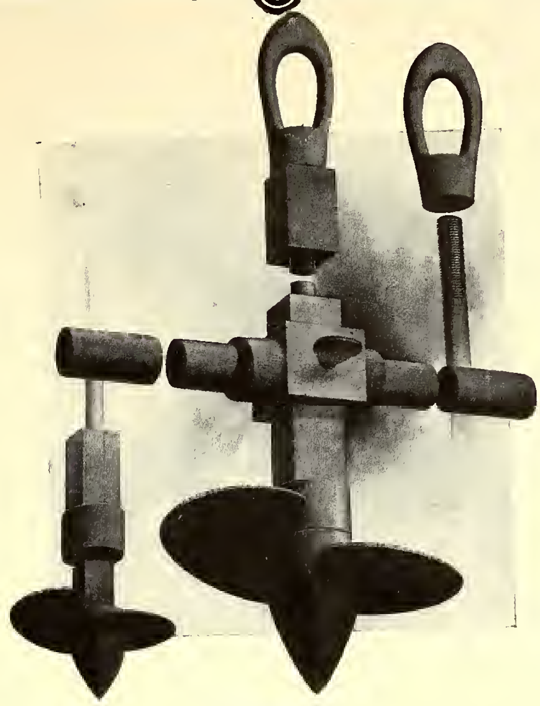
813A Arcade Bldg. Philadelphia, Pa.



Clamps that hold

TYPE B

PATENTED



DETAIL

Stombaugh Anchors

PATENTS PENDING

An Anchor is no Stronger than its Weakest Part

The Stombaugh Guy Anchor has no *weak* parts. It is one piece. No moving parts to rust, wear out or break. You do not have to dig a hole to bury it. Screws in like a corkscrew. There is no back give. *You know* when Stombaugh Guy Anchors are set. *You* are certain it will not give after your load is placed on it. Professor Carpenter's formula eliminates all guess work. *You* can be sure your poles, fences or smoke stacks are anchored right when using the Stombaugh Guy Anchor.

THE TYPE B STOMBAUGH GUY ANCHOR ADVANTAGES

The TYPE B anchor embodies a number of very important improvements on the old 5 and 6-inch STOMBAUGH GUY ANCHOR, which entirely overcome all objections and imperfections.

ALL WELDS HAVE BEEN ELIMINATED. RODS ARE FULL. ONE PIECE

The eyes are made of drop forged steel. They are made large enough for standard guy thimbles. They are threaded to the rod, and serve to lock the wrench securely to the anchor, absolutely preventing the wrench from jumping off the anchor during installation. The threads are figured to equal the strength of the rod. The shanks on anchors are made square. They are stronger. The shanks on the 5 and 6-inch anchors are made the same size. One wrench will fit either.

THE TYPE B STOMBAUGH WRENCH ADVANTAGES

The removable eye and the square shank on the Type B anchor makes it possible to use a square cold drawn seamless tube for the turning shaft of the wrench. This is much stronger, more convenient and more durable. This square tube is further reinforced at the bottom by a malleable iron key that is brazed on. It cannot wear out. The handles are mounted in a malleable sliding cross that can be moved up or down the shaft. This gives the maximum amount of leverage at all points of the installation. The cross is locked in position by means of the set screw. The handles can be taken off for convenience in carrying from place to place.

SEE THE HALF-TONE FOR DETAIL OF TYPE B IMPROVEMENTS

OUR PROPOSITION

We will ship by prepaid freight on 30 days' trial, to any point in the United States, 12 or more (no matter if 400 or 500 or more), granting the privilege of returning them at our expense if not entirely satisfactory. Pay for them only if satisfactory. A trial order for 5 or 6-inch anchors must include a wrench. No wrench is necessary for 8, 10 or 12-inch anchors. Freight will not be paid on less than 12 anchors.

Send for Handsome Illustrated 1906 Catalog

W. N. MATTHEWS & BRO.

MANUFACTURERS

217 N. 2nd Street : : ST. LOUIS

Eastern Office, 217 Taylor Bldg., Cortlandt St., New York

POLES

30 FOOT — 40 FOOT
35 " — 45 "

We have Poles of the above lengths (also other lengths) for sale for prompt shipment.

ALSO TIES

Naugle Pole & Tie Company
226 La Salle Street, Chicago

Cedar Poles
Write for Prices
John H. Fortier & Co
Fisher Bldg Chicago
TRADE MARK

POLES
Southern White Cedar (or Juniper)
Yellow Pine Octagonal

Georgia Pine Cross Arms
OUR SPECIALTY

SOUTHERN EXCHANGE CO., 97-101 Warren Street, New York

Idaho Cedar Poles
Buy Direct from the Producers.
HUMBIRD LUMBER COMPANY, Ltd.
SANDPOINT, IDAHO

Cross Ties, Chestnut Poles, Crossing Plank, Fir Timbers
West Virginia, Kentucky, Tennessee and Pacific Coast
D. G. GROVES & CO., Manhattan Bldg., Chicago, Ill.

Oak, Cypress and Chestnut Ties — Cypress Trolley Poles
PROMPTLY DELIVERED ANYWHERE
T. J. MOSS TIE CO., Security Building, St. Louis, Mo.

CHESTNUT OAK CEDAR } **POLES-TIES-PILING-POSTS**
GLENN-KLINE LUMBER CO., Whitfield Bldg., PITTSBURG, PA.

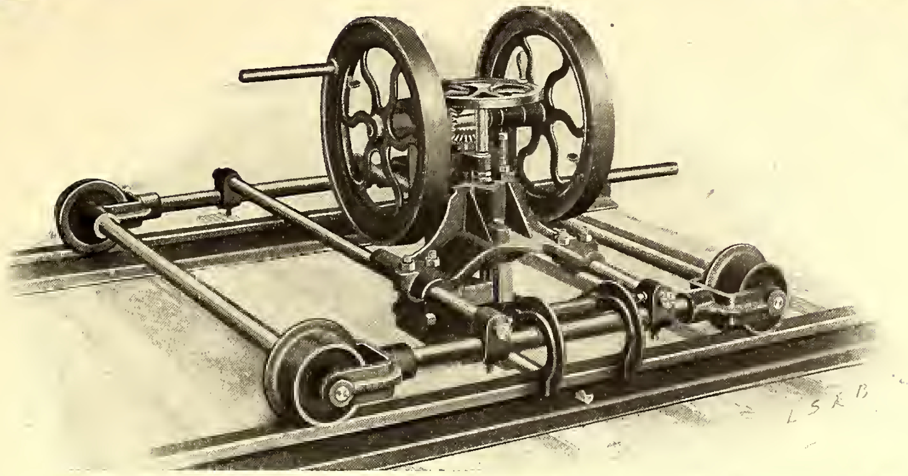
CROSS TIES FOR STREET RAILWAYS A SPECIALTY
. . . BRIDGE, TRACK AND CAR TIMBERS . . .
WHITE OAK AND CYPRESS PILING AND POLES
ABELES & TAUSSIG, - - - ST. LOUIS, MO.

POLES
LIVE PEELED WHITE CEDAR
Francis Beidler & Co.
CHICAGO, ILL.

CEDAR POLES
SPECIAL PRICES ON SMALL STOCK
C. H. WORCESTER COMPANY
PRODUCERS OF WHITE CEDAR PRODUCTS
1206 TRIBUNE BLDG. CHICAGO, ILL.

HEARNE TIMBER CO., Mermod & Jaccard Bldg., St. LOUIS, MO.
WHITE AND RED OAK TIES
BRIDGE AND SWITCH TIES
CYPRESS POLES AND PILING

POLES MICHIGAN and IDAHO CEDAR
THE F. BISSELL COMPANY. TRADE MARK
TOLEDO, O.



LUDLOW TRACK DRILL

Send for Circulars Describing Same

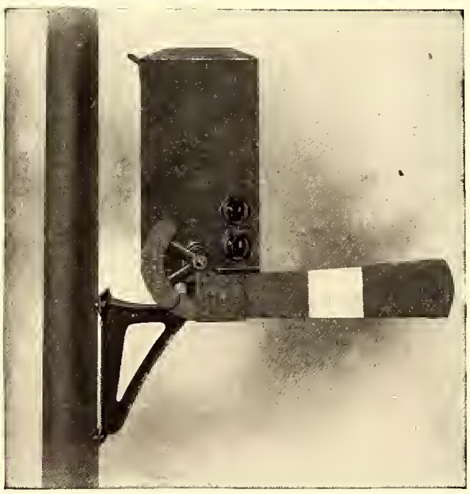
WE REFER YOU TO THE FOLLOWING USERS:

	NO. IN USE.	KIND.		
A. B. Hogue, Greenwood, Ind	1	Single	Hand	Power.
Stark Electric Company, Alliance, O	2	"	"	"
Sydney Railroad, Sydney, Australia	2	"	"	"
Mahoning Valley Railway Company, Youngstown, O	2	"	"	"
Springfield & Xenia Ry. Co., Xenia, O	1	"	"	"
Indiana Union Traction Company, Anderson, Ind	2	"	"	"
Fox Brothers & Company, New York City	1	"	"	"
New York & Long Island Tr. Co., Hempstead, L. I.	1	"	Electric	"
Cleveland, Painesville & Ashtabula Ry., Cleveland, O	1	"	Hand	"
Detroit & Toledo Cons Co., Detroit, Mich	1	"	Electric	"
Toledo & Western Ry. Co., Toledo, O	1	"	"	"
Illinois Valley Tr. Co., Springfield, Ill	2	"	Hand	"
Northern Ohio Tr. & Lt. Co., Akron, O	1	"	"	"
Porter & Berg, Chicago, Ill	1	"	Electric	"
Tennis Company, Cincinnati, O	2	"	Hand	"
Louisville Railway Company, Louisville, Ky	1	"	"	"
Middlesex & Somerset Tr. Co. Milltown, N. J	1	"	"	"
Wagenhals & Company, Cincinnati, O	1	"	"	"
Knox Construction Company, Chicago, Ill	1	"	"	"
Consolidated Ry. & Pwr. Co., Salt Lake City, Utah	1	"	"	"
Dayton & Western Tr. Co., West Alexandria, O	1	"	"	"
Watts & Uthoff Supply Company, St. Louis, Mo	1	"	"	"
The Falk Company, Milwaukee, Wis	1	"	"	"
Ohio & Indiana Ry., & Lt. Co., Angola, Ind	1	"	"	"
Pittsburg, McKeesport & Connellsville Ry. Co., Pittsburg, Pa	1	"	Electric	"
Indianapolis & Northern Tr. Co., Anderson, Ind	2	"	Hand	"
Douglas Reduction Works, Douglas, Ariz	1	"	"	"
Cincinnati & Columbus Tr. Co., Cincinnati, O	1	"	"	"
A. B. Hogue, Greenwood, Ind	3	"	Electric	"
Everett Ry. & Elec. Co., Everett, Wash	1	"	Hand	"
Tennis Brothers Company, Pittsburg, Pa	1	"	"	"
Albany & Hudson R. R. Co., Hudson, N. Y	1	"	Electric	"
Munice, Hartford & Ft. Wayne Ry., Montpelier, Ind	1	"	Hand	"
Cedar Rapids, Iowa City & So. Cons. Co., Cedar Rapids, Ia	2	"	"	"
Cleveland Electric Railway Co., Cleveland, O	1	"	Electric	"
Milwaukee Electric Ry. Co., Milwaukee, Wis	1	"	Hand	"
Clift Wise, Chicago, Ill	2	"	"	"
Louisiana Purchase Exposition Co., St. Louis, Mo	2	"	"	"
Rhode Island Company, Providence R. I	1	"	Electric	"
Pensacola Electric Terminal Co., Pensacola, Fla	1	"	"	"
Indianapolis & Cincinnati Tr. Co., Indianapolis, Ind	4	"	Hand	"
Rhode Island Company, Providence, R. I	1	Double	Electric	"
Jas. F. Show & Company, Boston, Mass	1	"	"	"
Cedar Rapids, Iowa City & So. Cons. Co., Cedar Rapids, Ia	1	"	Hand	"
Mitsui & Company, Kobe, Japan	4	Single	"	"
Cleveland Electric Railway Co., Cleveland, O	1	Double	Electric	"
Holyoke St. Ry. Co., Holyoke, Mass	1	"	Hand	"
Pepper & Register, Philadelphia, Pa	2	"	"	"
Oregon Water Power & Ry. Co., Portland, Ore	1	"	Electric	"
L. T. Leiter, Zeigler, Ill	1	Single	"	"
Connecticut Ry. & Lt. Co., Waterbury, Conn	1	Double	"	"
Rochester Railway Company, Rochester, N. Y	1	"	"	"
Pepper & Register, Philadelphia, Pa	1	Single	Hand	"
Cincinnati Traction Company, Cincinnati, O	1	Double	Electric	"
Frankfort & Versailles Tr. Co., Frankfort, Ky	1	Single	Hand	"
Utica & Mohawk Valley Ry., Utica, N. Y	1	Double	Electric	"
British Columbia Elec. Ry., Vancouver, B. C	1	"	Hand	"
Central Illinois Cons. Co., Springfield, Ill	2	Single	"	"
East St. Louis Suburban Ry., St. Louis, Mo	1	"	"	"
Hamilton Cataract Pow. St. Trac. Co., Hamilton, Ont	1	"	"	"
Chicago Southern Trac. Co., Chicago, Ill	1	"	"	"
Spokane Inland Ry. Co., Spokane, Wash	1	"	"	"

CLEVELAND ARMATURE WORKS

CLEVELAND, OHIO

ST. R'Y JOURNAL



THE RAIL JOINT COMPANY

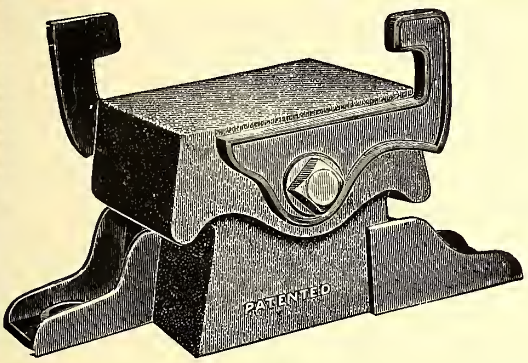
General Offices: 29 West 34th St., New York City

Makers of Continuous, Weber & Wolhaupter Rail Joints

Protected by United States Patents

BRANCH SELLING AGENCIES:

ATLANTA, GA.	Eng. Am. Bldg.
BALTIMORE, MD.	Union Trust Bldg.
BOSTON, MASS.	India Bldg.
CHICAGO, ILL.	Monadnock Bldg.
CINCINNATI, OHIO	1st. Nat. Bk. Bldg
DENVER, COLO.	Equitable Bldg.
NEW YORK, N. Y	29 W. 34th St.
NEW ORLEANS, LA.	Hennun Bldg.
TROY, N. Y.	Burden Avenue
PITTSBURG, PA.	Lewis Block
SEATTLE, WASH.	Alaska Bldg.
ST. PAUL, MINN.	Pioneer Press Bldg.
ST. LOUIS, MO.	Commercial Trust Bldg.



350,000

RECONSTRUCTED GRANITE

Third-Rail Insulators

NOW IN USE

RECONSTRUCTED GRANITE CO., 14 Dey Street, NEW YORK

Electric Railway Special Work
FROGS, SWITCHES, CURVES, CROSSINGS, RAIL BRACES, ETC.

The Weir Frog Co., Cincinnati, O.
New York Agent, JILSON J. COLEMAN, 35 Nassau Street

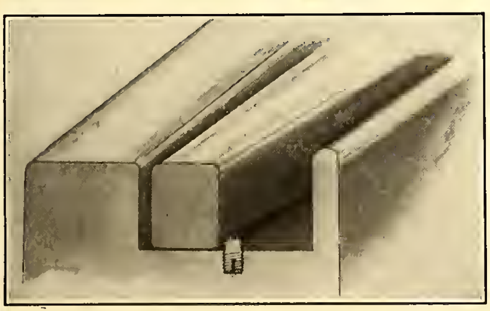
THE AMERICAN FROG AND SWITCH CO. Hamilton, Ohio
SPECIAL TRACK WORK FOR ELECTRIC RAILWAYS

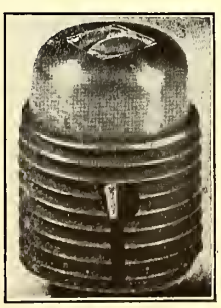
We Have for Sale the Engineering Books of All Publishers
IN THE UNITED STATES AND EUROPE.

There is no Engineering Book that is not either published or for sale by us. Send us your inquiries.

Book Department McGRAW PUBLISHING COMPANY *114 Liberty St., N. Y.*

BLANCHARD RAILWAY SWITCH LOCK





PREVENTS ACCIDENTS

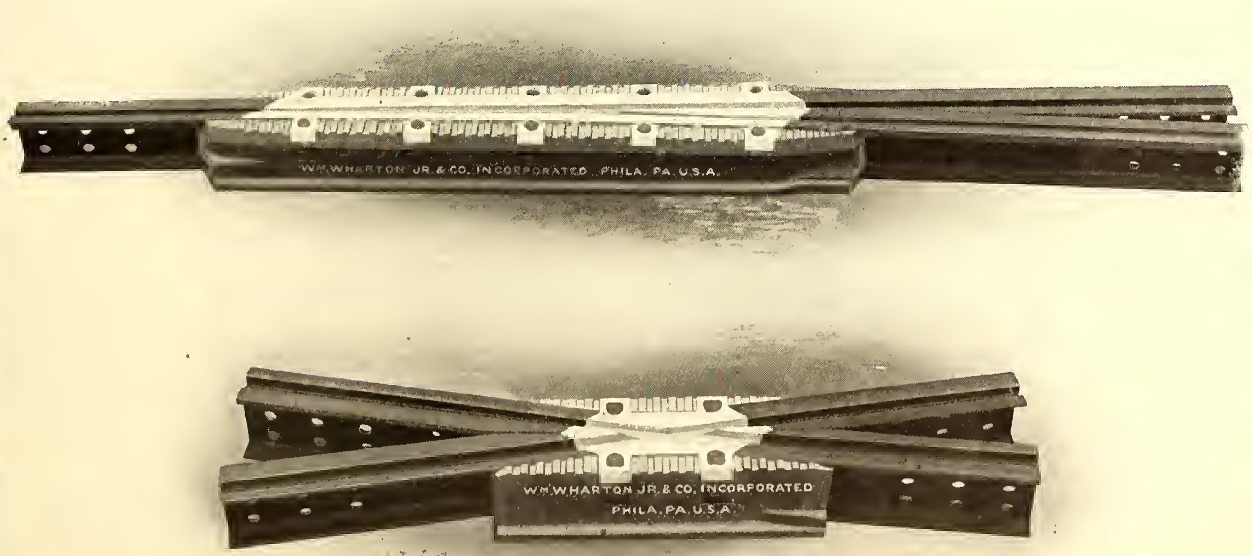
With our device installed it is impossible for flanges of rear wheels to throw switch tongue in opposite position, causing the forward wheels to take one set of rails and the rear wheels another.

A Simple, Positive Lock, Easily Installed and Easily Operated.

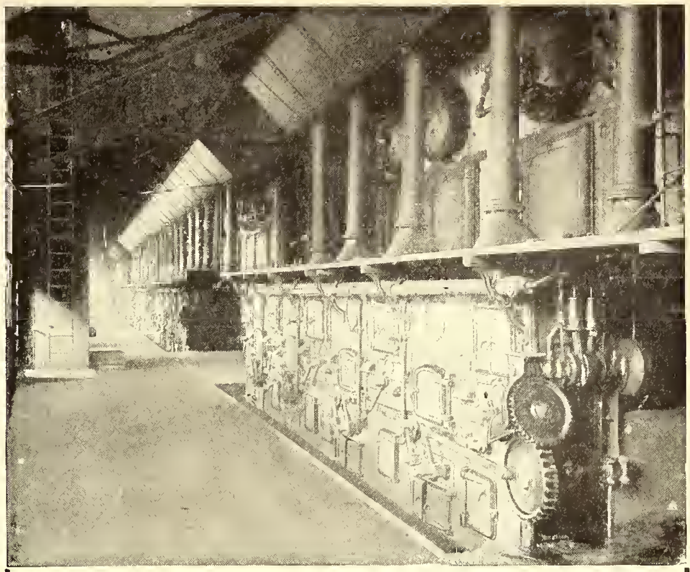
We will give any electric railroad in the world a trial of our device, upon request

161 West Springfield Street, BOSTON, Mass.

BLANCHARD RAILWAY SWITCH LOCK CO.



EASILY RENEWABLE CENTER CONSTRUCTION



Murphy Furnaces applied to 5,000 H.-P. B. & W Boilers Northwestern Elevated R. R. Power House Chicago, Ill.

CLEAN BOILERS

DEARBORN WATER TREATMENT

Made to suit the case. Takes off the scale, keeps it off, stops corrosion and foaming. Send gallon of water for analysis.

DEARBORN DRUG & CHEMICAL WORKS. Wm. H. Edgar, Founder

NEW YORK, 299 BROADWAY — CHICAGO, POSTAL TELEGRAPH BUILDING

GENERAL MANAGER—
"Where did that pile of stuff come from?"

SUPERINTENDENT—
"Out of that boiler."

G. M.—"I don't believe it; you couldn't get it back in again."

SUPT.—"Well, it did; a Weinland Mechanical Cleaner did it."

G. M.—"Then buy some more of them."

The above conversation actually occurred at the plant of the Tennessee Coal, Iron & R. R. Co., Ensley, Ala. Some people to whom we have shown the photograph were as incredulous as the General Manager about the amount of scale that could come from a boiler, but it isn't so strange if you remember that in a 200 H. P. boiler, say, there are 2000 to 2250 square feet of tube surface, or the equivalent of a room about 46 ft. square. If this area were covered with scale $\frac{1}{4}$ in. thick, and we have often found cases where it was thicker, there would be over 45 cu. ft. of scale when solid and about 72 cu. ft., or two wagon loads, when loosened up.

Think of trying to dissolve all this matter with "boiler compound" or rattle it out with flimsy cleaners. Only the Weinland Mechanical Cleaner, which bores into and cuts through *any* thickness or hardness of scale, will do the work. We sell or rent these machines or clean boilers by contract. We have been 20 years at it and never failed to do a good job.

Send for our Catalog No. 24

We also make Turbine Cleaners, Tube Cutters, Reseating Machines and Damper Regulators

The Lagonda Manufacturing Co., Springfield, Ohio

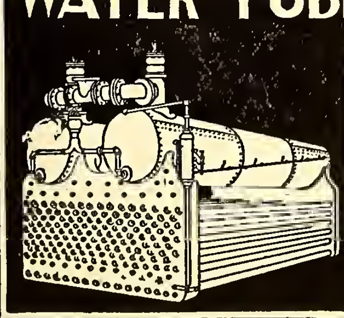
BOILER CLEANER EXPERTS! AT IT TWENTY YEARS!

FOSTER SUPERHEATERS

INSURE DRY STEAM

POWER SPECIALTY COMPANY
111 BROADWAY, NEW YORK

WATER TUBE STEAM BOILERS



THE KIND THAT ARE IMITATED ARE
MANUFACTURED ONLY BY

HEINE SAFETY BOILER CO.

421 Olive Street, St. Louis, U. S. A.

PARKER BOILER

Double Ended Boilers Save Floor Space

Boiler, Economizer and Superheater in same setting save coal

Third order J. B. Stetson Co., 5,000 H.P.
Fifth order Philadelphia Rapid Transit Co., 15,000 H.P.

WRITE FOR BOOKLET

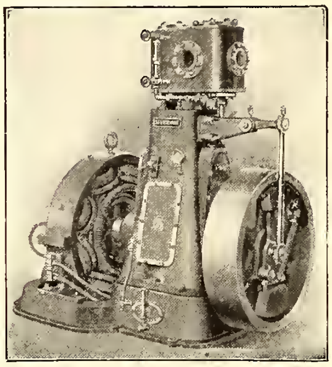
Parker Boiler Company
DEPT. C.
Penna. Building, PHILADELPHIA

WHEN WRITING TO ADVERTISERS in the STREET RAILWAY JOURNAL you will confer a favor on both publisher and advertiser by mentioning this paper.

The Bearing Surfaces Run on Oil,

not on each other, in the case of Sturtevant Engines equipped with forced lubrication under 15 pounds pressure. Mechanical efficiency of 95 per cent is secured thereby. The generator is correspondingly efficient.

SEND FOR BULLETIN 63.



B. F. STURTEVANT CO.

Boston, Mass.

GENERAL OFFICE AND WORKS . . HYDE PARK, MASS.
NEW YORK PHILADELPHIA CHICAGO LONDON

Designers and Builders of Heating, Ventilating, Drying and Mechanical Draft Apparatus; Fans, Blowers and Exhausters; Steam Engines, Electric Motors and Generating Sets; Fuel Economizers; Forges, Exhaust Heads, Steam Traps, Etc. 485

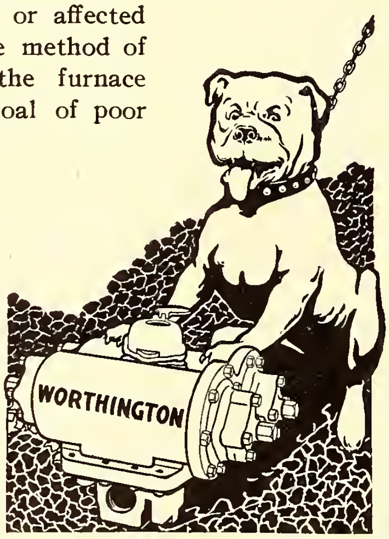
Put a WATCH DOG on the COAL PILE

YOU should know how many pounds of steam you get for every dollar's worth of coal.

The Worthington Hot Water Meter

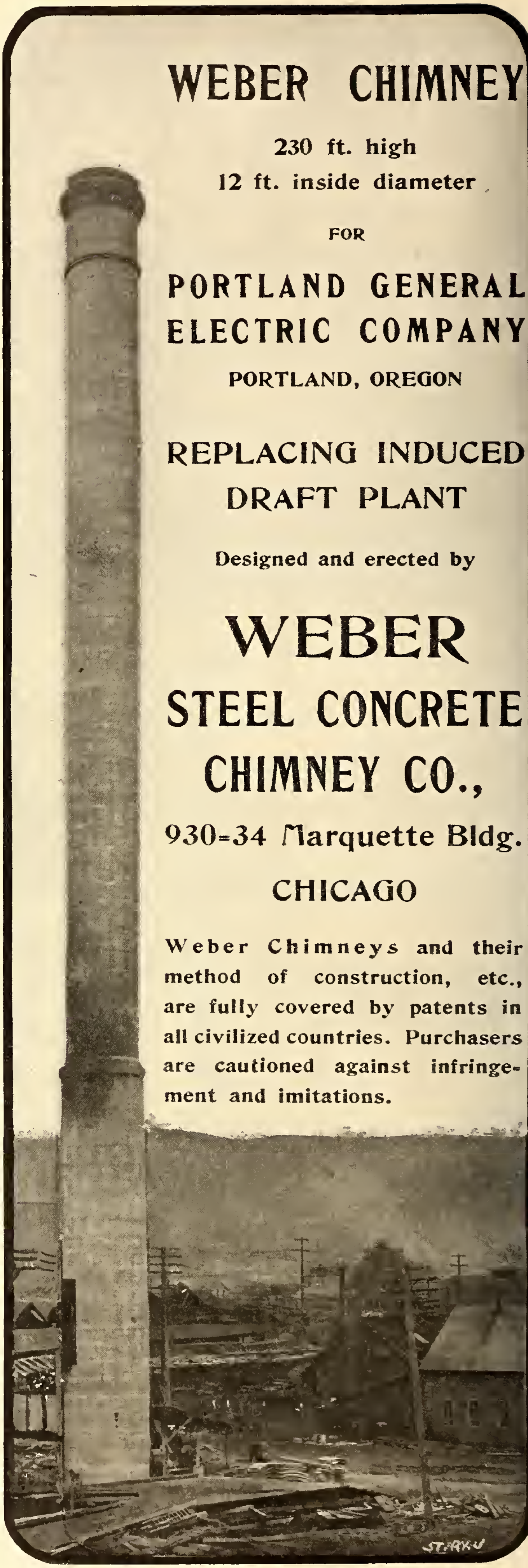
Makes it easy to keep a record of boiler-plant economy. It shows when the boiler is overtaxed or affected by scale or soot, the method of firing inefficient, the furnace defective, or the coal of poor quality.

It is essential to good management.



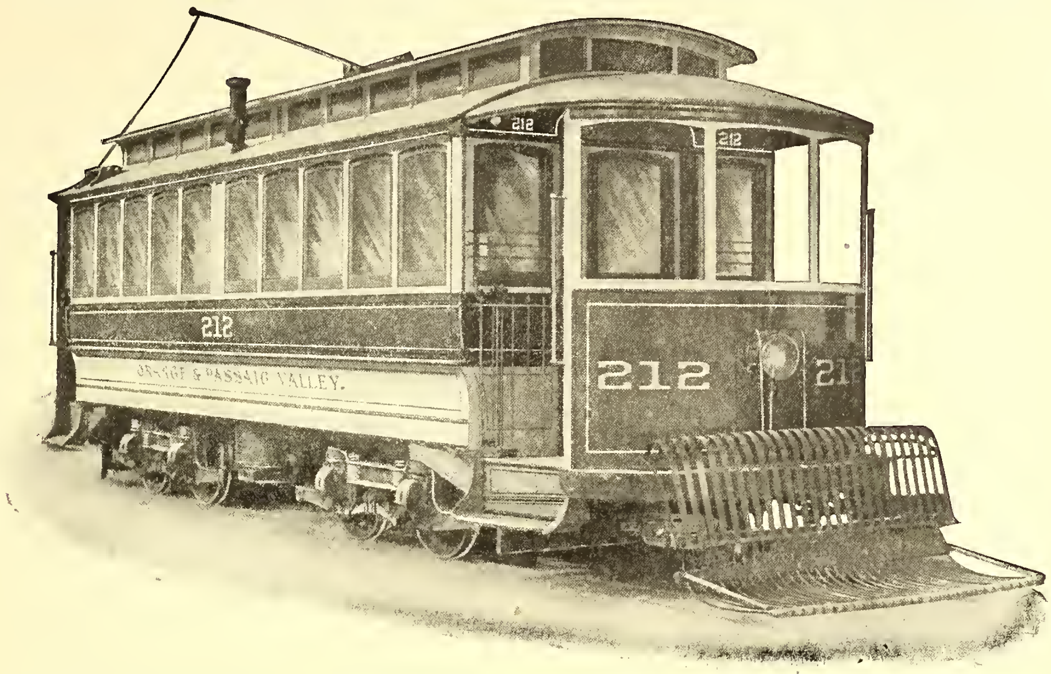
Henry R. Worthington

114 Liberty St., New York.



"Providence" Car Fenders

Over 18,000 Providence Fenders are in use on over 265 roads. This is not surprising. ***THE PROVIDENCE*** meets absolutely every requirement of the ideal fender.



Note Carefully the Construction.—The Fender is composed of two distinct parts, the Cradle and the Cushion. The Cradle, which is 6 feet wide and 3 feet long, is formed of curved steel ribs tempered to a point that will bend before breaking, and arranged parallel to the axis of the car. The back of this cradle is hinged to the front of the platform by means of adjustable brackets so that it may be turned up against the Dash, or down so that its front edge will rest on the track or set to occupy and be carried in any intermediate position.

Two Steel bars, attached to the cradle and projecting to the rear under the platform, hold the cradle at any desired height. By means of a latch or trigger, being pressed by the motorman's foot, the cradle is released so that its front edge drops to the ground.

The front edge of the cradle consists of a steel rod, passing through eyes formed on the ends of the curved ribs on this rod, and between the curved ribs are rubber rolls 1¾ inches in diameter.

The Cushion is a resilient shield made of carefully tempered steel bands. Its purpose is to cover the iron bumper and all other projecting parts of the platform so as to effectually cushion the blow of a person falling against it. This Cushion is hinged to the cradle so that the two form a unit which may readily be removed, or transferred from one end of the car to the other.

Consolidated Car Fender Company

Manufacturers of the "Providence Car Fender," "Millen Step Lifter" and "Campbell Rotary Snow Broom."

Office and Factory, Providence, R. I.

Branch Office: 39-41 Cortlandt Street, New York

You Can Trust an International Register

¶ It's built so that it simply can't cheat its employer—there's no going wrong gear in it.

¶ If you want a good honest register that will not fool you and can't be fooled, then it's the International Register you want.

¶ Our catalog describes its makeup and record in detail.

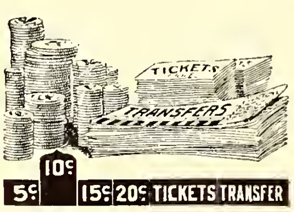
THE INTERNATIONAL REGISTER CO.

124 W. Jackson Boulevard CHICAGO, ILL.

All Types of Ohmer Registers are

RECORDING MACHINES

(Founded on **original patents, providing for printing two or more classifications of fares, separately**)



SYSTEMATIC and PROTECTIVE

THEY are tireless, reliable bookkeepers, automatically recording each fare collected, under its proper denomination at the time it is paid. They relieve street and interurban railway conductors of clerical duties, and more than save their cost in various ways.

We build and mount registers to meet all requirements.
Information cheerfully given. Address

OHMER FARE REGISTER CO., Dayton, O., U.S.A.

The Climax HEADLIGHT

A COMBINATION arc and incandescent headlight for all-round service. It throws a powerful, steady, white light nearly 1,500 feet ahead of car. The motorman, therefore, has at all times a commanding view of track for about a quarter mile, and can discover danger ahead in time to prevent it.

One and one-half amperes give a good arc; the maximum amount consumed is 3½ amperes. This means economy in current consumption.

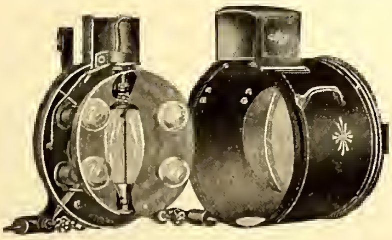
Economical in other ways, too. Few parts greatly reduce possibility of disarrangement, and they likewise make for durability. Cost of maintenance, therefore, is as low as it is possible to make it.

The arc light is of course the superior of the incandescent light. But the Climax has both, as some towns do not permit the use of the arc light. The change from one to the other is made by simply changing switch or plug.

The Climax Headlight has stood the test of time and hard practical city and interurban service.

Price reasonable.

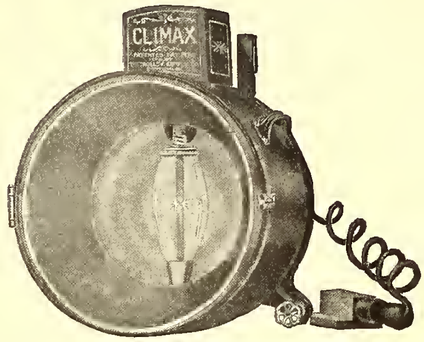
We solicit an opportunity to make known to you all of the advantages of the Climax Headlight for your road.



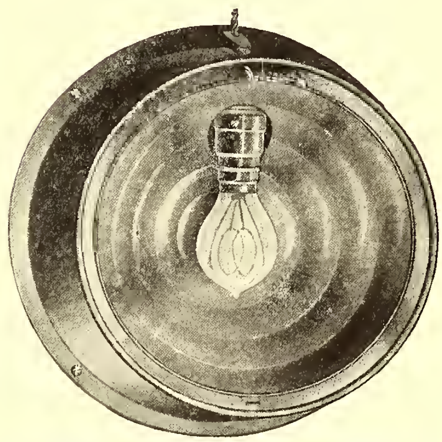
COMBINATION HEADLIGHT
OPEN VIEW

TROLLEY SUPPLY COMPANY

Canton, Ohio, U.S.A.

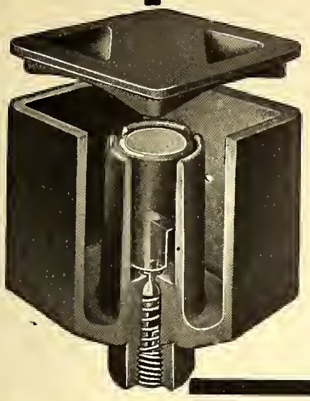


ARC HEADLIGHT



DASH HEADLIGHT WITH MULTIPLEX REFLECTOR

DASH HEADLIGHT WITH PARABOLIC REFLECTOR



JOLT LUBRICATORS

Automatically and economically lubricate armature and axle bearings of electric cars with oil, instead of grease.
Lubrication positive and direct, without wicks, waste, or felt packing.
Feeds only when car is in motion; quantity regulated according to requirements. Can be installed on any car without lay-up or delay.
For detail information, write

JOLT LUBRICATOR CO.

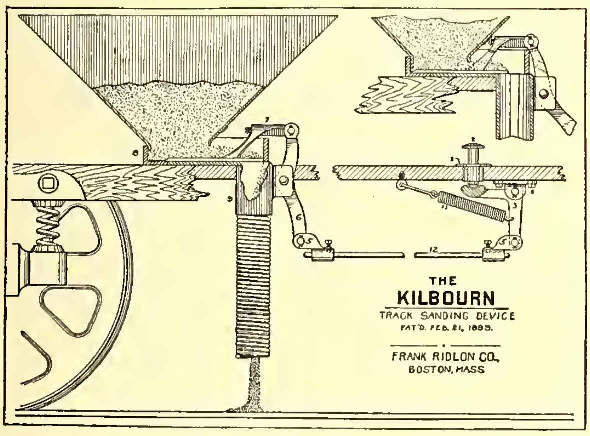
326 South Water Street, PROVIDENCE, R. I.

It takes sand

to keep things going on these wet or icy days. Here's the

Kilbourn Track Sanding Device—

hundreds of roads swear by it—it has helped them through many a hard winter.
Handles anything from fine sand to gravel or crushed stone—wet or dry, puts the stuff where you want it in just the right quantity—neither too much nor too little.
Mighty seldom breaks or gets out of order
Let us equip a car for you on trial.
Have you our complete supply catalogue?

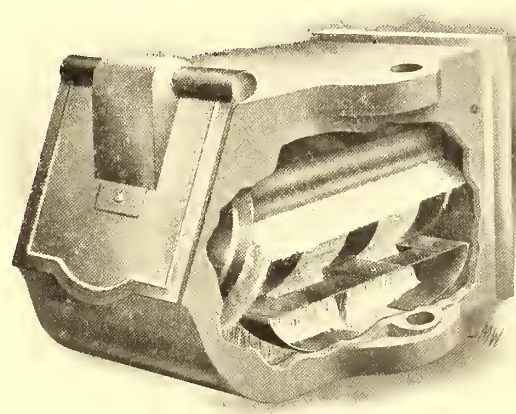


Frank Ridlon Company, Manu-facturers
200 Summer Street Boston, Mass.

Agents: New York City: A. Hall Berry
San Francisco and Los Angeles, Cal.: Estes Electrical Co.
St. Louis, Missouri: The Wesco Supply Co.
Toledo, Ohio: The F. Bissell Co.

ARMSTRONG
(PATENTED)

Journal Oilers
For All Types of Trucks



THE ARMSTRONG JOURNAL OILER (PATENTED)

SIMPLE—PRACTICAL—CHEAP

Saves Oil, Journals, Bearings
Labor, Money. **Prevents** Hot Boxes

Samples for trial. Catalogues and information cheerfully furnished.

Armstrong Oiler Co. 31st below Chestnut Street PHILADELPHIA.

Sand Dryers
For Street Railways

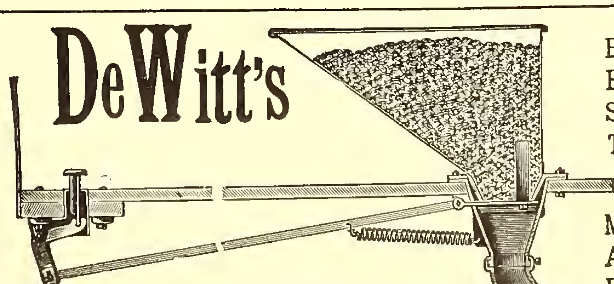
Automatic—no labor required to operate
Low cost to install
Simple in construction

Write for Full Information

AMERICAN PROCESS CO.
64 William Street, - - NEW YORK

DeWitt's

BEST MADE



THE ONLY SAND BOX ON THE MARKET that has worked twelve years without repairs or refused to work with dry or damp sand, or dirt picked up along the roadside. Has never been replaced by others, but has taken the place of other sand boxes many times.

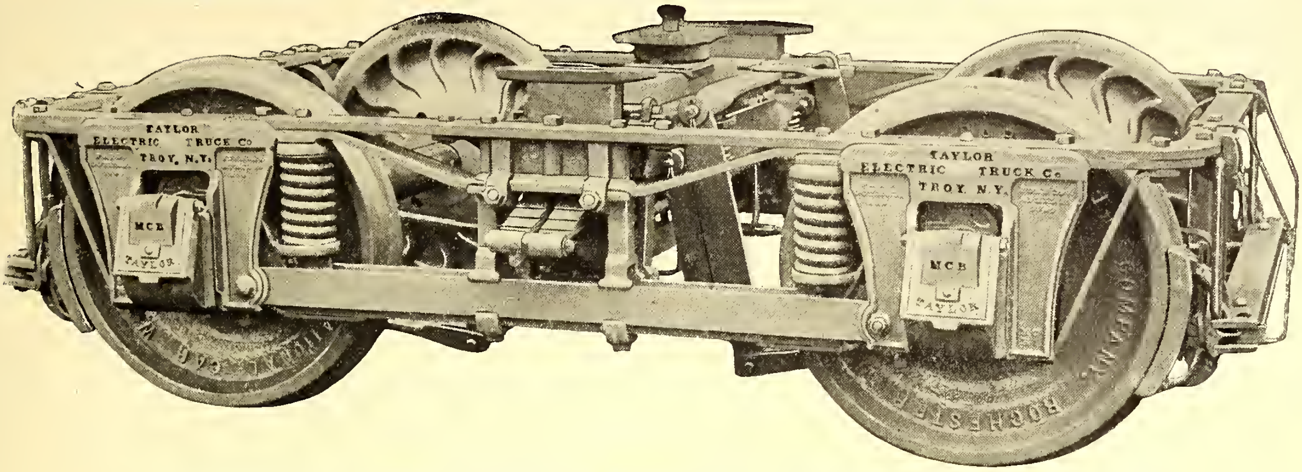
☞ *Don't purchase inferior boxes when you can buy our box at a low figure. Save your wheels by using our box and foot-power.*

No company will ever regret having bought the Dewitt Sand Box, as they have never had a complaint.

523-525 Fifth Avenue, TROY, New York **DeWitt Sand Box Co.**

TAYLOR
M. C. B. DOUBLE TRUCK

IS SUPERIOR TO ALL OTHERS FOR HIGH SPEED SERVICE

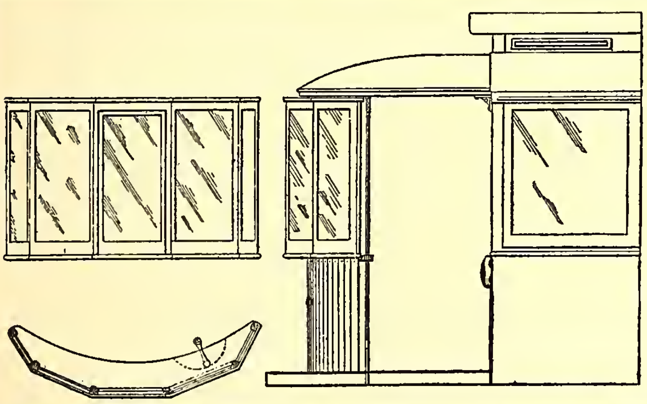


Constructed on the best principles of Master Car Builders' standard practice. The brakes are of the live and dead lever system, so that air-brakes can be used if desired.

TAYLOR ELECTRIC TRUCK CO., Troy, N. Y., U. S. A.

AGENTS FOR GREAT BRITAIN:
ESTLER BROTHERS, 25 Laurence Pountney Lane,
CANNON STREET, LONDON, E. C.

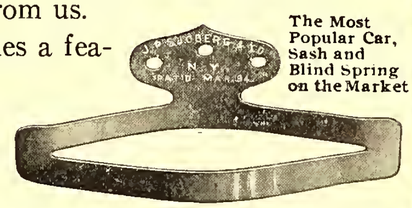
Our export trade (outside of Great Britain) is handled exclusively by
DUTILH-SMITH, McMILLAN & CO.
BROAD EXCHANGE BLDG., NEW YORK



Car Vestibules

of any design; portable and stationary. You will save money by getting these, and any other *car parts*, from us.

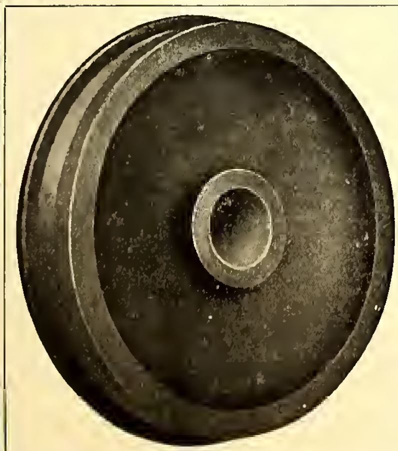
Prompt deliveries a feature.



The Most Popular Car, Sash and Blind Spring on the Market

Write us.

J. P. Sjoberg & Co., 533-539 W. 32d St., New York



STANDARD STEEL WORKS

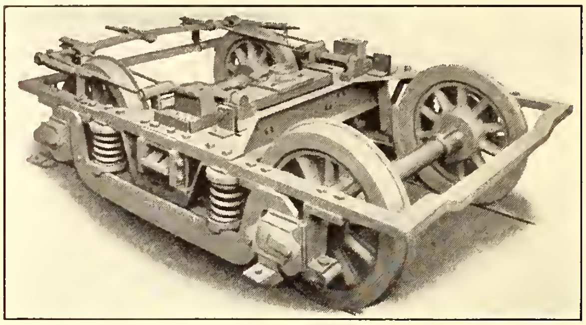
TIRES. STEEL TIRED WHEELS

SOLID FORGED ROLLED WHEELS

FORGINGS CASTINGS SPRINGS

Harrison Building Philadelphia, Pa.

Baldwin Locomotive Works



Motor Truck for South Side Elevated Railway. One of an order for 300.

Builders of
Locomotives of every description
and of

Electric Trucks

Double Trucks for Street Railway, Interurban, and Long Distance Service. Workmanship in conformity with best Locomotive practice.

Trucks built to meet individual requirements. Purchasers' designs followed if desired.

Burnham, Williams & Co.,
Philadelphia, Pa., U. S. A.

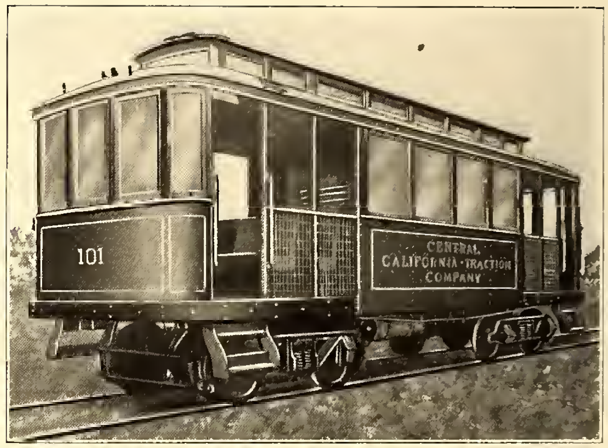
Cars and Trucks

Our specialty is cars for the Pacific Coast, and it might be noted in that connection that we were the originators and patentees of what has become the standard car for California—the double end California Car.

Cars may be personally inspected during course of construction. This will also appeal particularly to Companies on the Pacific Coast.

We build trucks, too—good trucks. Let us estimate on YOUR work.

J. HAMMOND & CO.
7th and King Sts. SAN FRANCISCO, CAL.



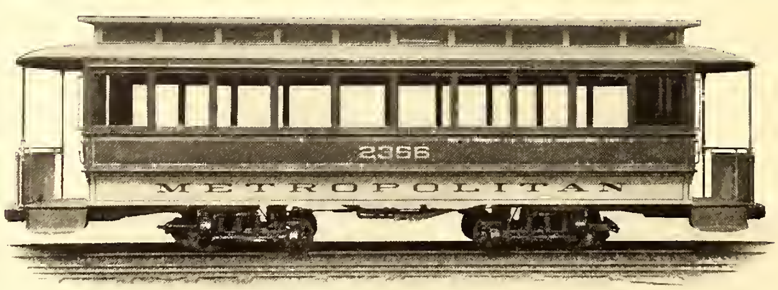
PRESSED STEEL CAR COMPANY

DESIGNERS AND BUILDERS OF

STEEL PASSENGER CARS AND TRUCKS

FOR STEAM AND ELECTRIC RAILWAYS

Non-Combustible



Non-Telescoping

ALSO

STEEL AND COMPOSITE FREIGHT CARS FOR ALL CLASSES OF SERVICE

OFFICES: PITTSBURGH, NEW YORK, CHICAGO, ATLANTA, LONDON, MEXICO CITY, SYDNEY, N. S. W.

PHILADELPHIA

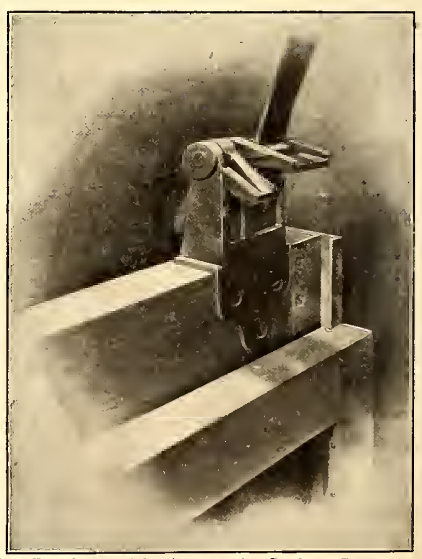
J. G. BRILL COMPANY
AMERICAN CAR COMPANY

ST. LOUIS

CARS & TRUCKS · SPRINGS ·

Brill Grooveless Post Semi-Convertible Car (Patented). Lower sash attached to upper by metal tongue-and-groove sliding connections. Rollers in brackets at top of upper sash move on bow-shaped steel guides and conduct sashes into roof pockets.

HAVING the window spaces clear of the sashes whenever desired is not the only advantage of the Brill Semi-Convertible. The window pockets being in the side roofs, the space which would otherwise be occupied by them in the side walls is given to the seats and aisle, and six to seven and a half inches is worth considering. The operation of the sashes is greatly in favor of our car. Have you ever handled a pair of sashes of the Grooveless Post Semi-Convertible? Just one easy lift and they are safe in the pocket, and moreover the sashes may be held at any desired height by five window-lock stops. Dropping the sashes into a wall window pocket means two or more operations; the hands must be changed from bottom to top of sash, and if not careful, hands will get pinched. Most passengers let the sash slam down into the pocket, which is safer for their hands than for the sash. ¶To say that the propensity of a certain class of passengers to use the wall window pocket as a rubbish collector and substitute for a cuspidor is a nuisance, is to put it mildly—it is a serious menace to the health of all who ride in the cars. The side roof is the logical place for the window pocket—there is no reason why it should not be put there, and every reason why it should. ¶Another thing, the low window sill obtained by not having wall window pockets is a decided advantage, and one that is everywhere appreciated. It makes the car more open, and brighter and more attractive in winter. The standard height of the top of window sill from the floor in the Brill Semi-Convertible is $24\frac{5}{8}$-inches. ¶The car costs no more for maintenance than an ordinary type, as the system of sliding the sashes into the roof pockets is too simple to get out of order. The sashes have brass stiles arranged with tongue-and-groove sliding connections. The lower sash slides upon the upper and when the tops are abreast an automatic spring catch is released and both sashes are moved into the pockets by means of bow-shaped steel guides. The sashes cannot stick nor rattle.



Roller Bracket, with Automatic Spring Catch, used with Grooveless Post Convertible and Semi-Convertible Sash Systems. Note Tongue-and-Groove Sliding Connections of Sashes.

SAN FRANCISCO OFFICE, 308 MARKET ST. | LONDON OFFICE, 110 CANNON ST., E.C. | AUSTRALASIAN AGENTS, NOYES BROS., SYDNEY.

CLEVELAND

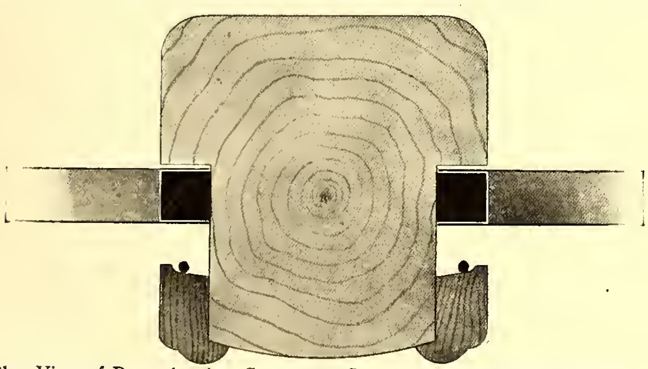
G. C. KUHLMAN CAR COMPANY
JOHN STEPHENSON COMPANY

ELIZABETH

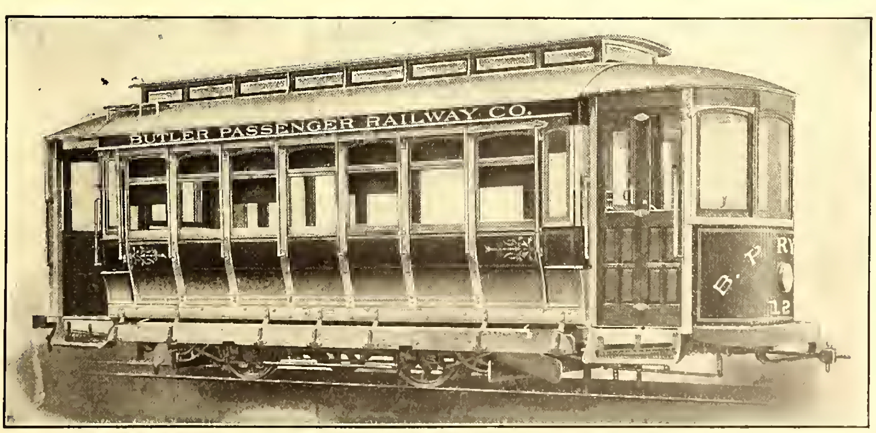
CARS & TRUCKS · SUPPLIES

THAT the Brill Convertible is self-contained is one of the greatest things in its favor. So far as meeting weather conditions is concerned, one might as well have two sets of cars as to use convertibles which are not self-contained. If the sashes or panels must be taken out or replaced whenever it is desired to convert the car, all that can be claimed for such a system is that it saves using two sets of cars. Our Convertible, with its panels and sashes easily raised into pockets in the side roofs, can be changed as often as the weather, and without costing a cent for labor, storage and broken glass. ¶Wherever the car goes the public quickly appreciates the comfort and protection that it always gives, with more fares as the consequence, particularly in unseasonable weather and on threatening days. Its appearance is also in its favor—it looks like a standard car, either open or closed, and has all the standard features. The car is built for hard city service; is strong and durable in every part and costs no more for maintenance than an ordinary type. Passengers as well as conductors may operate the sashes and panels, as there is no chance of getting them out of order, and anyone with moderate intelligence and strength can accomplish it. ¶The posts are not cut into for grooves or runways. The sashes are conducted into the roof pockets in the same manner as in the Semi-Convertible car, and the panels slide on metal guides attached to the surface of the posts. Powerful locks hold both sashes and panels in the roof pockets and safety devices are provided to prevent the parts from dropping but a few inches should they not be pushed up far enough. The system is perfect.

Section of Brill Grooveless Post Convertible Car (Patented). The Window System is the same as the Semi-Convertible. Flexible Metal Panels slide into Roof Pockets by means of metal guides on the posts.



Plan View of Post, showing Grooveless Construction and method of sliding panels on metal guides. The dots represent curtain wires.



Brill Grooveless Post Convertible Car (Patented). Length over end panels 20 ft. 7 ins. Mounted on Brill No. 21-E Truck.

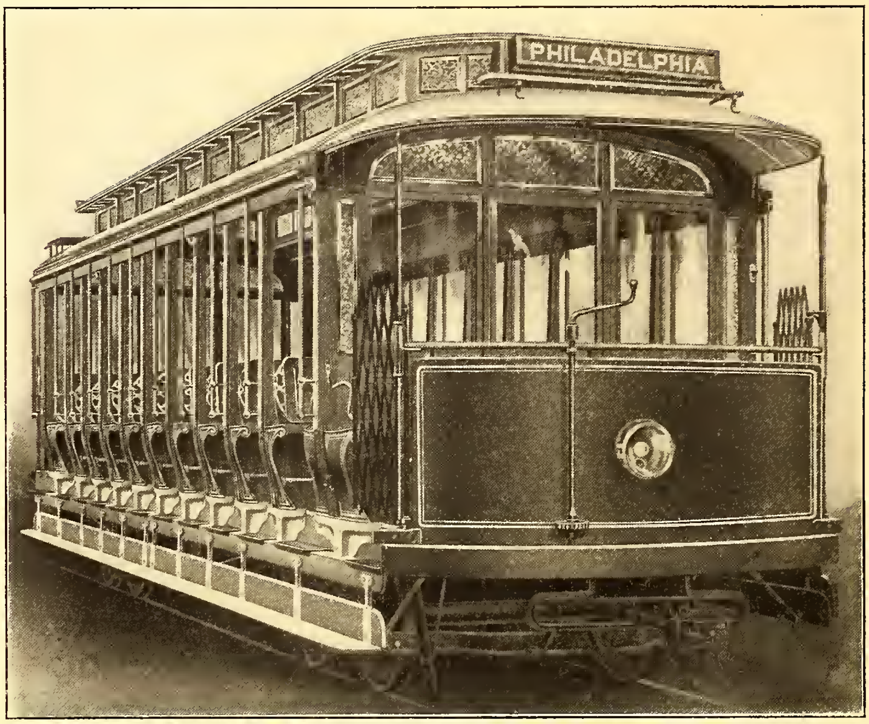
SAN FRANCISCO OFFICE, 308 MARKET ST | LONDON OFFICE, 110 CANNON ST., E.C | AUSTRALASIAN AGENTS, NOYES BROS., SYDNEY.

PHILADELPHIA

J. G. BRILL COMPANY
AMERICAN CAR COMPANY

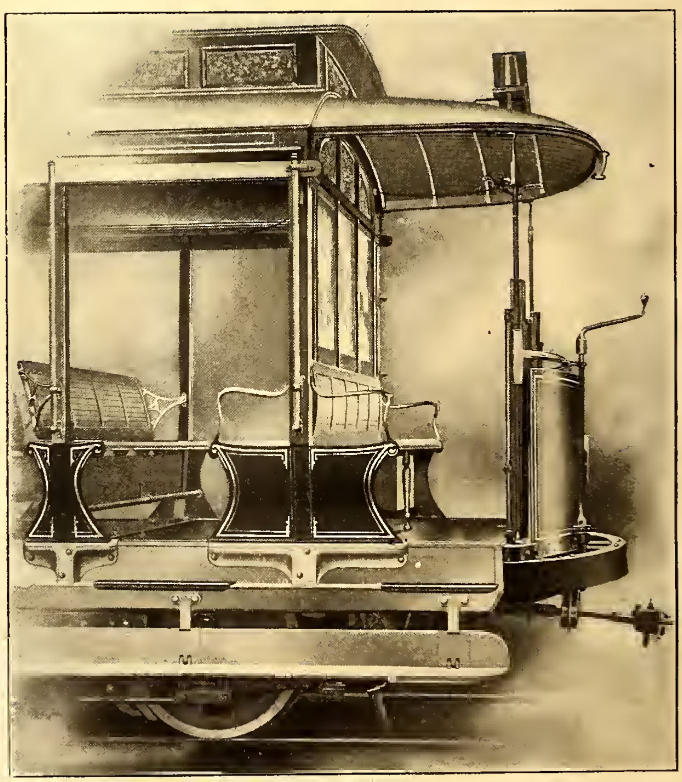
ST. LOUIS

CARS & TRUCKS • SPRINGS •



Brill Narragansett Car (Patented). No wider over all than a car without the sill step. Mounted on Brill No. 27-GE-1 Trucks.

THE 19½-inches from the rail-head to the step, or running-board, of a single-step double-truck car is too much for women and children, and even awkward and unsafe for men, and the 17-inches from the step to the car floor is worse still, for the passenger must pull himself between the posts, a more difficult operation than drawing himself up in front of it as he does to reach the first step. Now it is impossible to have the car floor lower than 36½-inches, and the height of the single-step mentioned is probably the best under the circumstances. The double-step is therefore a genuine necessity, and we have it in the Narragansett, without exceeding the width over all of the single-step car, for the upper step is on the lower flange of Z-bar sills, and the step heights respectively 16, 13 and 7½ inches. ¶Z-bar sills are much stronger than timber, in fact the Narragansett is the strongest open car ever built. The posts have a deep setting in brackets bolted to the sills. The lower part of the posts are enclosed in Brill Patented Round-Corner Seat-End Panels, as the illustration shows. The seats are full standard length, and in every way the car has all the good features of standard construction, with the advantages of easy ingress and egress and greater strength. For summer excursion service it has no equal, and is the only practical open car for mounting on double trucks having equal-sized wheels.



From track to running-board, 16 ins.; from board to sill step, 13 ins.; from sill step to floor, 7½ ins. Seats are full standard length.

SAN FRANCISCO OFFICE, 308 MARKET ST. | LONDON OFFICE, 110 CANNON ST., E.C. | AUSTRALASIAN AGENTS, NOYES BROS., SYDNEY.

CLEVELAND

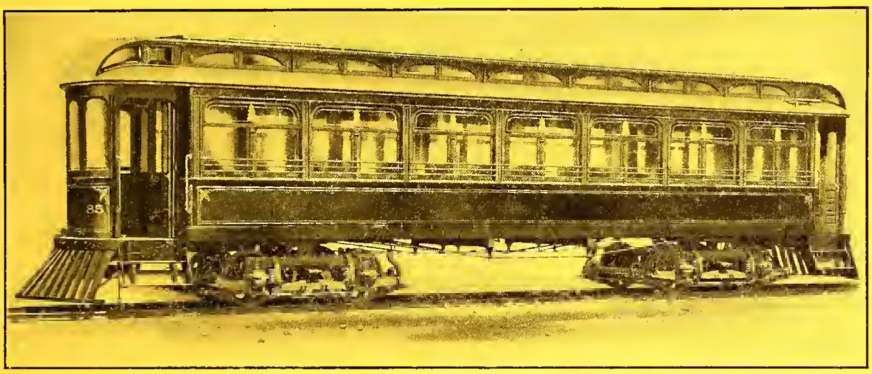
G. C. KUHLMAN CAR COMPANY
JOHN STEPHENSON COMPANY

ELIZABETH

CARS & TRUCKS · SUPPLIES

THE three types of interurban cars shown on this page are excellent representatives of three classes of service. The first is suited to mixed conditions, such as systems where the cars are operated through city streets and take on their passengers from the pavement. Dropped platforms are therefore used and single platform steps. The width is the same as a city car, 8-feet 2-inches over the posts. The cars are arranged for operating singly or in trains, and are suitable for running at high speed. ¶The second car is a combination passenger and smoker of a type of which we have built many for interurban lines in the Middle West. Dropped platforms are also used on this type with a pair of steps on each side, low enough to make it easy for passengers to enter from the roadside without the necessity of platforms. The twin windows give a pleasing effect from the outside, and the interior of the dome is of the Semi-Empire style to correspond. The Brill Semi-Convertible window system may be included and still preserve the same appearance of the windows as shown, with the advantage of suiting the car better to summer service. ¶The third type is of a class suited to operation singly or in trains on systems operating in practically the same manner as steam roads. Doors at the centre of the vestibules permit passing from one car to another. The trucks are equipped with no less than four systems of brake control, necessary because these cars are operated on a 60 mile per hour schedule, on a road where curves are frequent and grades heavy. ¶Straight sills, tight joints, and thoroughly satisfactory condition after a number of years of service, are characteristics of our interurban cars. The large number which we have built enables us to submit photographs and blue prints which will closely approximate the needs of any buyer.

A type suited to systems which combine urban and interurban conditions. Length over body, 34-ft. Length ove. vestibules, 43-ft. 5-ins. Mounted on Brill No. 27-E-1½ Trucks.



Interurban passenger and smoker type; largely used in the Middle West. Length over body, 39-ft. 10-ins. Length over vestibules, 48-ft. 6-in. Mounted on Brill No. 27-E-1½ Trucks.

Combination passenger and baggage car for use on systems with conditions similar to steam roads. Length over body, 43-ft. Length over vestibules, 51-ft. Mounted on Brill No. 27-E-2 Trucks.

SAN FRANCISCO OFFICE, 308 MARKET ST — LONDON OFFICE, 110 CANNON ST., E.C — AUSTRALASIAN AGENTS, NOYES BROS., SYDNEY.