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 mak-

ing 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 ventilation, 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.

TYPICAL BUSINESS STREET, BIRMINGHAM, ALA.

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.

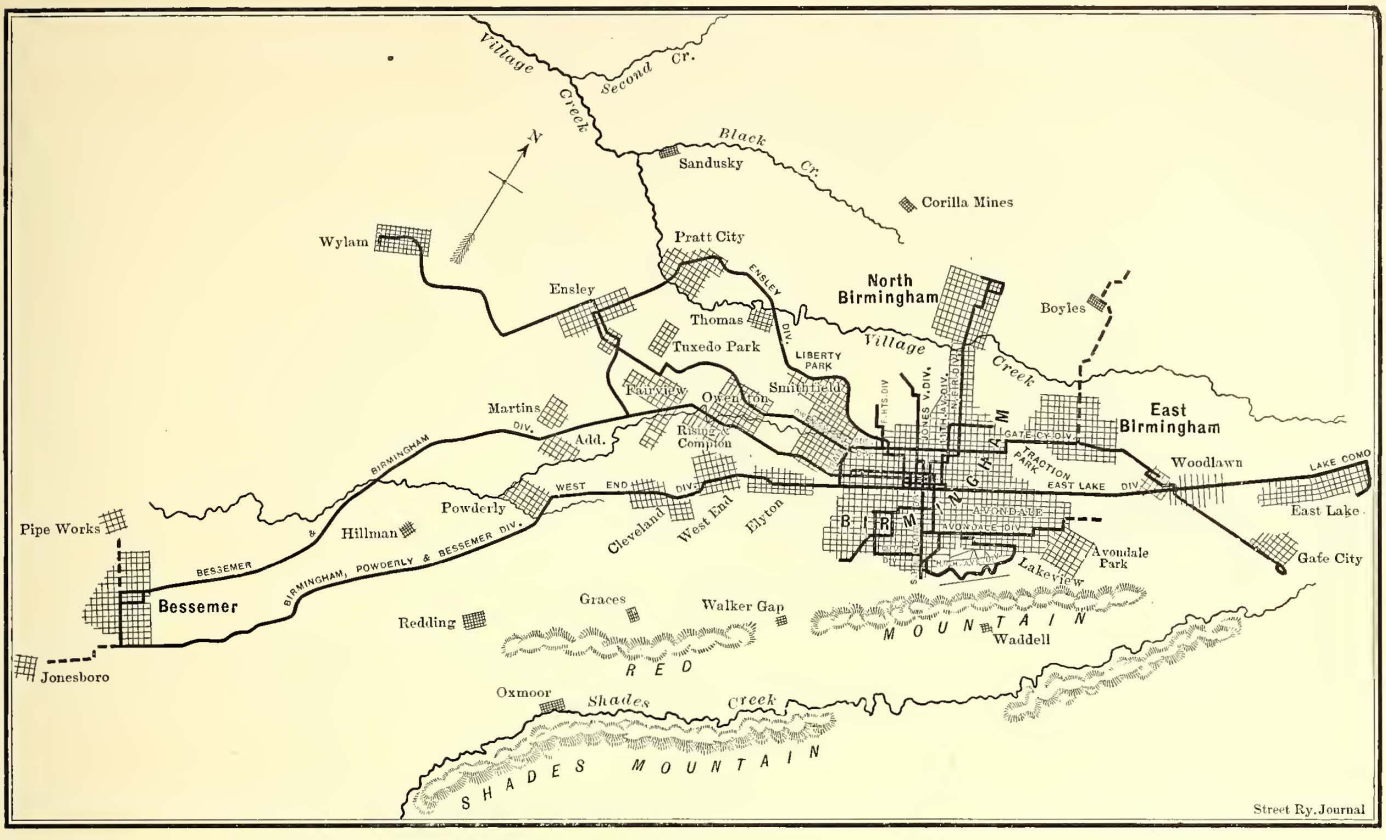
The franchises of the company covering the gas, electric light and nearly all of the street railway business in the city of Birmingham, are unlimited in time. A majority of the franchises under which the company operates its railway lines outside of Birmingham, are either unlimited in time or its tracks 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.

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 men-

tioned. 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

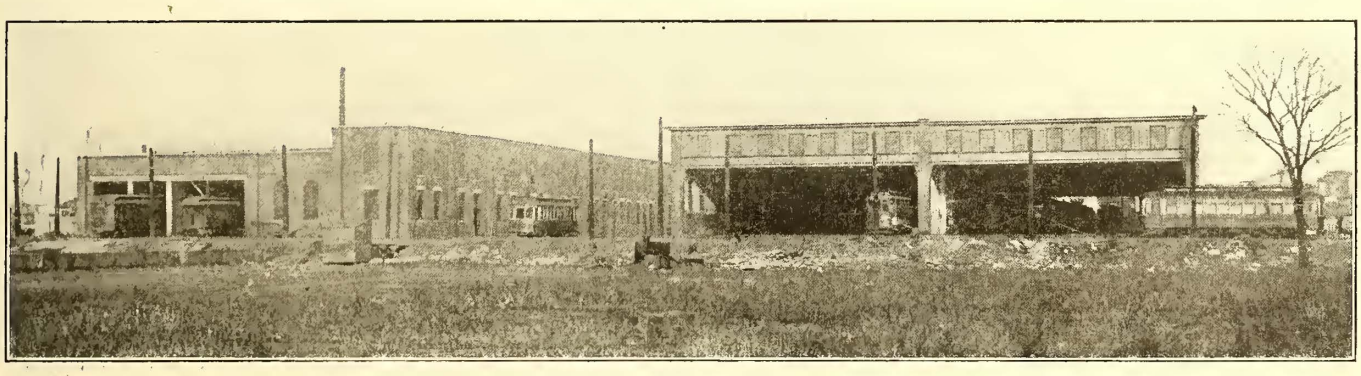


MAP SHOWING LINES OWNED AND TERRITORY SERVED BY THE BIRMINGHAM RAILWAY, LIGHT & POWER COMPANY, OF BIRMINGHAM, ALA.

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-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

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 transportation 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



REPAIR SHOPS AND CAR HOUSE, BIRMINGHAM RAILWAY & ELECTRIC COMPANY

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.

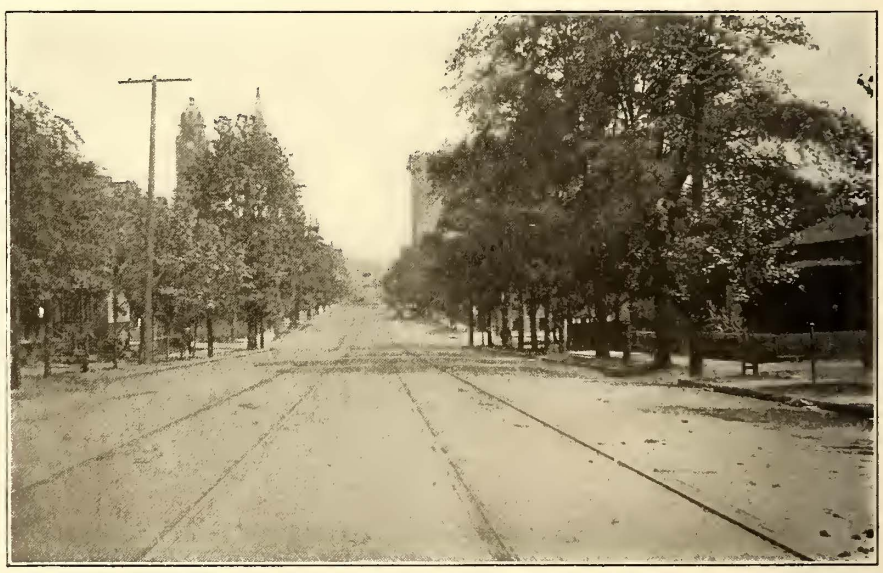
Within the last four years, virtually the entire overhead construction on the railway lines has been renewed or reconstructed. In the direction of securing uniformity, span suspension with No. 000 grooved trolley wire supported from creosoted pine poles 14 ins. sq. at the base and tapering to 8 ins. 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 practi-

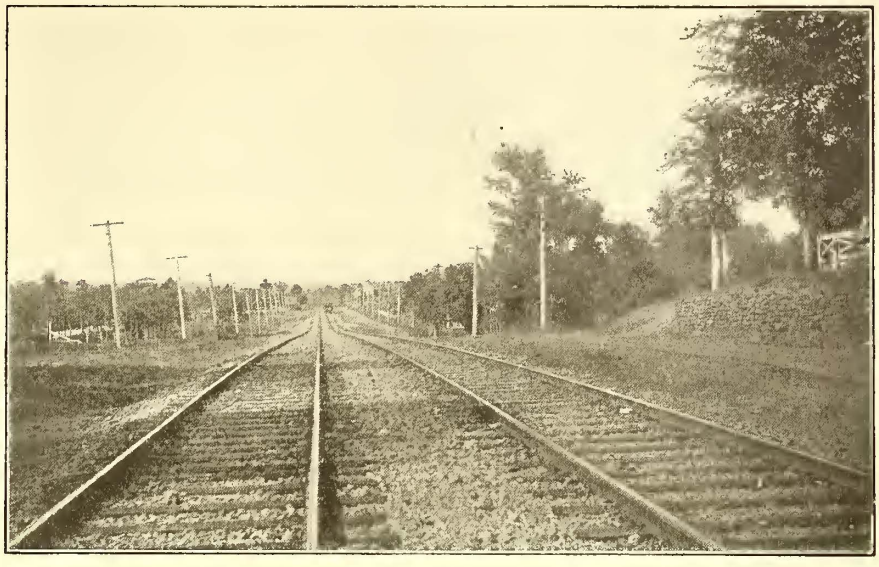
cally no grades on any part of the system, and any of the double-truck motor cars are able to handle easily a long trail car seating forty people. The experience on this system has been that the running of trail cars does not necessarily increase the accident account, providing the same degree of care 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

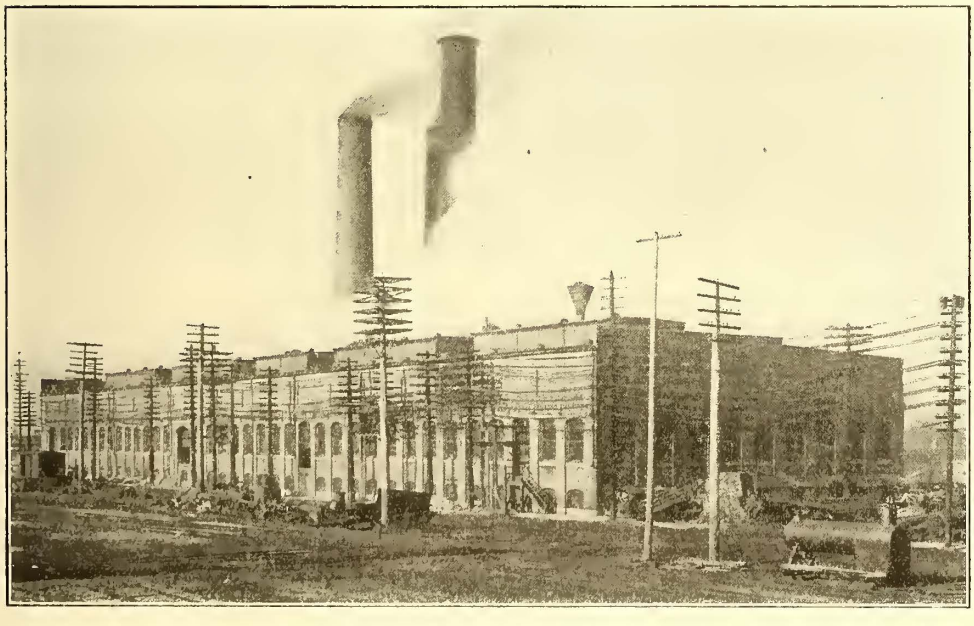
Power for the entire railway, lighting and steam heating business is supplied from one power house, which is being completely remodeled and extended. This work has developed a number of interesting engineering problems, an outline of which, with the solutions that have been applied, will also be made 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.

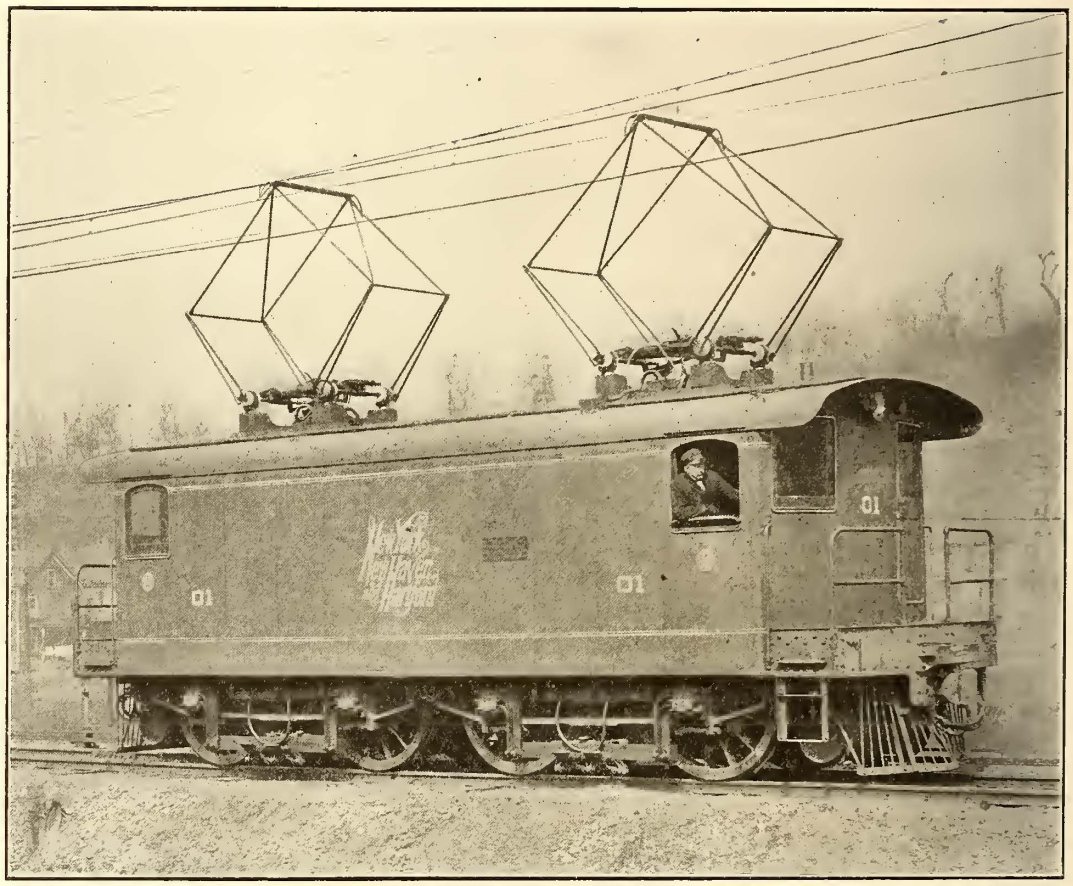
This difficulty can be overcome in a single locomotive by keeping all drivers of the same diameter or by the use of side rods, but this is not feasible when a number of separate locomotives are to drive the same load. When it is borne in mind that the drivers of different locomotives may have as much 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.



THE FIRST COMBINATION SINGLE-PHASE AND DIRECT-CURRENT LOCOMOTIVE FOR THE NEW YORK, NEW HAVEN & HARTFORD RAILROAD

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:

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 oper-

ated 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.

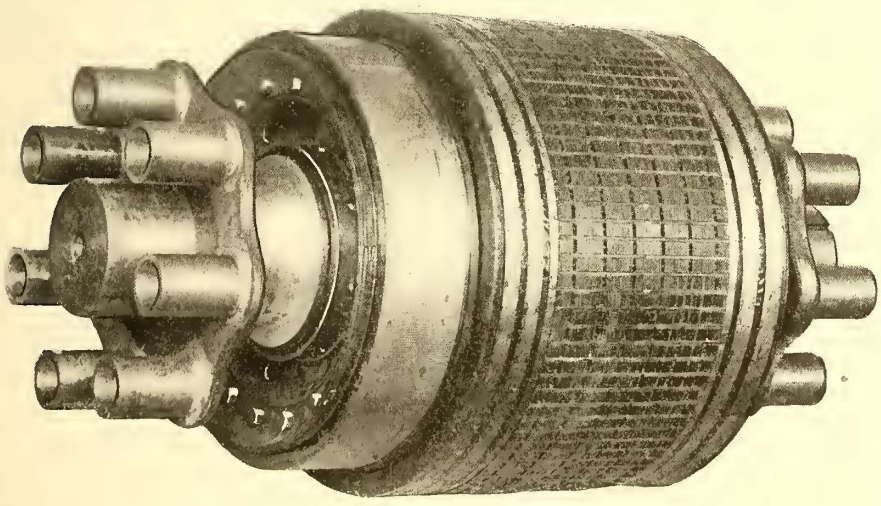
7th. The motor is inherently of a variable-speed type, and can automatically adjust its speed to that of other motors driving the same load, with but very small unbalancing of the loads on the individual motors.

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.

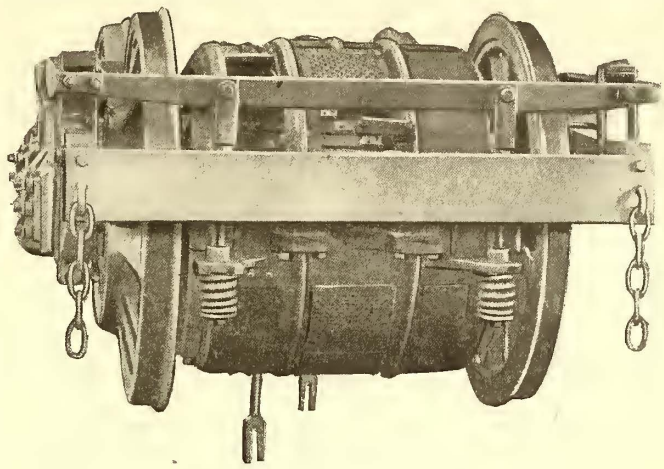
The motors of the single phase system can readily meet the first of these conditions; namely, that of feeding power into a resistance. As the motors are of the commutator type, and are, in reality, first-class direct-current machines, they will readily pick up as d. c. generators and can feed power into a suitably proportioned resistance. This method of braking is



ARMATURE COMPLETE, WITH QUILL SUSPENSION

perfectly feasible, provided the controlling apparatus and car circuits are arranged for this purpose.

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



NEW HAVEN MOTOR IN POSITION ON TRUCK

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.

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.

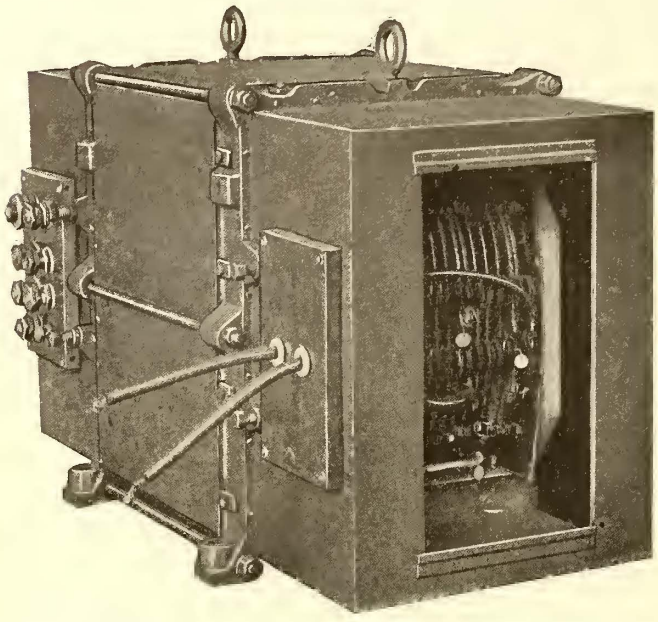
In the past few months, two contracts have been taken by the Westinghouse Electric & Manufacturing Company for single-phase railway equipment involving locomotives of steam railway size. These are for the equipment of part of the New York, New Haven & Hartford Railway system and for the electrification 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.

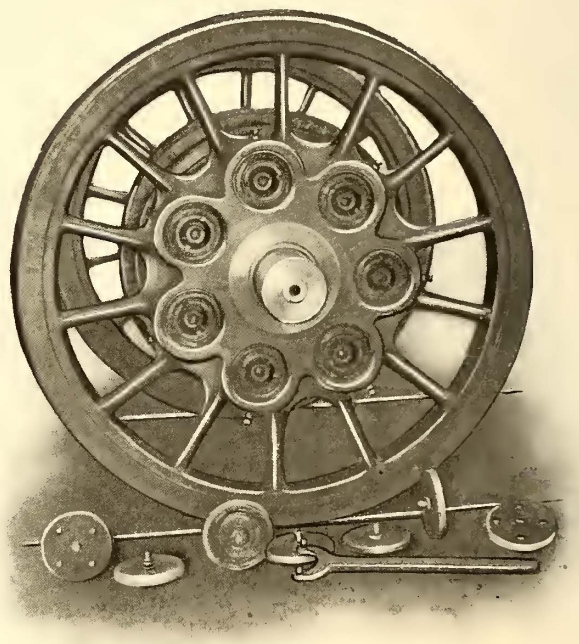
The steam turbines for driving these generators are of the Westinghouse-Parsons type. On account of the large output and high speed an unusually good performance is indicated. The engines are designed for the single-phase rating of the generators, as it is anticipated that the heavy service and the load 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

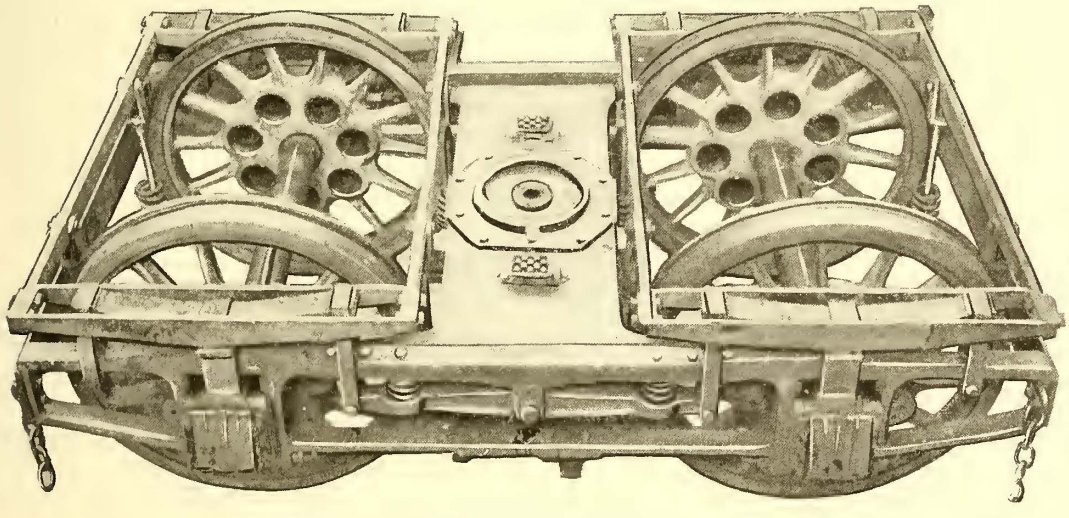
wires just mentioned are carried the whole length of the alternating system, and by means of these and the arrangement of automatic switches, any entire section of four or more trolleys could be cut out of service and the sections beyond can be kept in service.

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 sub-station 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 dif-

ferent 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:

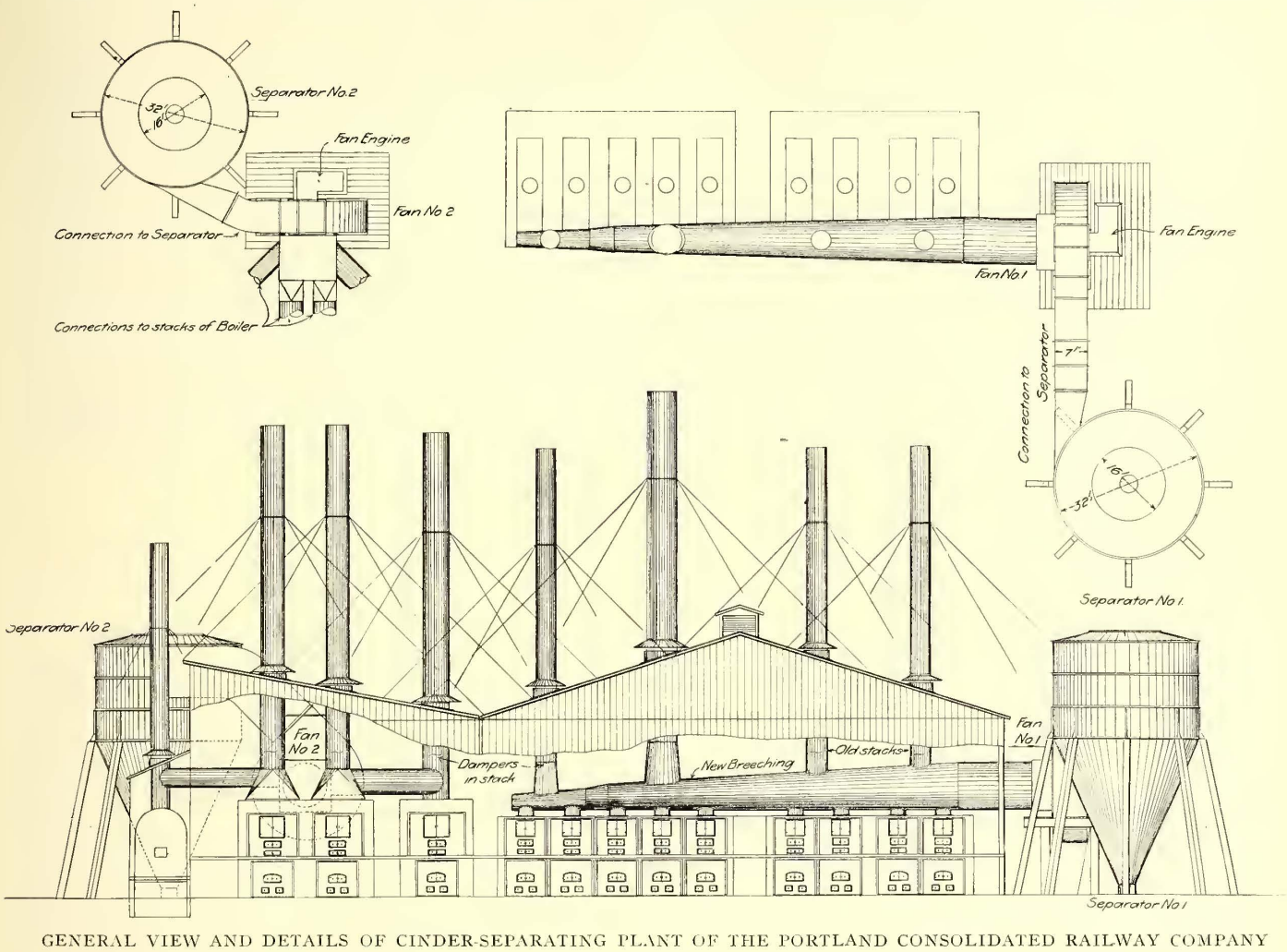
Dear Sir:—Without at present offering any argument on the question of the advisability of separating, on future subways, contracts for equipment and operation from those of construction, I beg to state that if such separation be made, either by virtue of a decision on the part of the Rapid Transit Commission 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

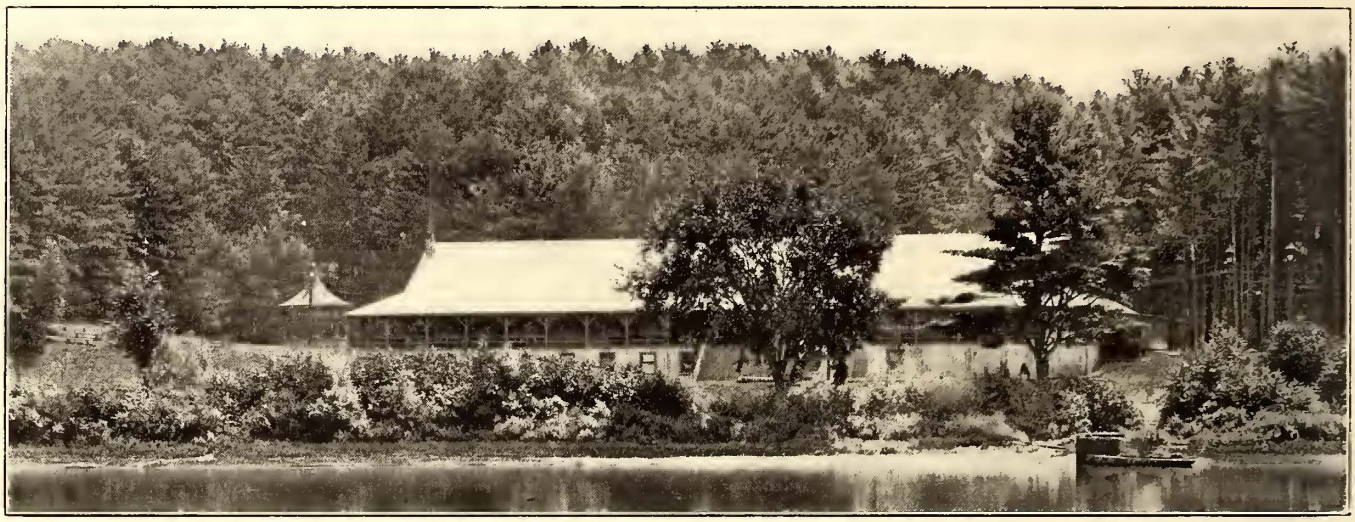
PARK PLANS OF THE BOSTON, NORTHERN & OLD COLONY STREET RAILWAY COMPANIES

BY H. A. FAULKNER,
Passenger Agent of the B. & N. St. Ry. Co. and the O. C. St. Ry. Co.

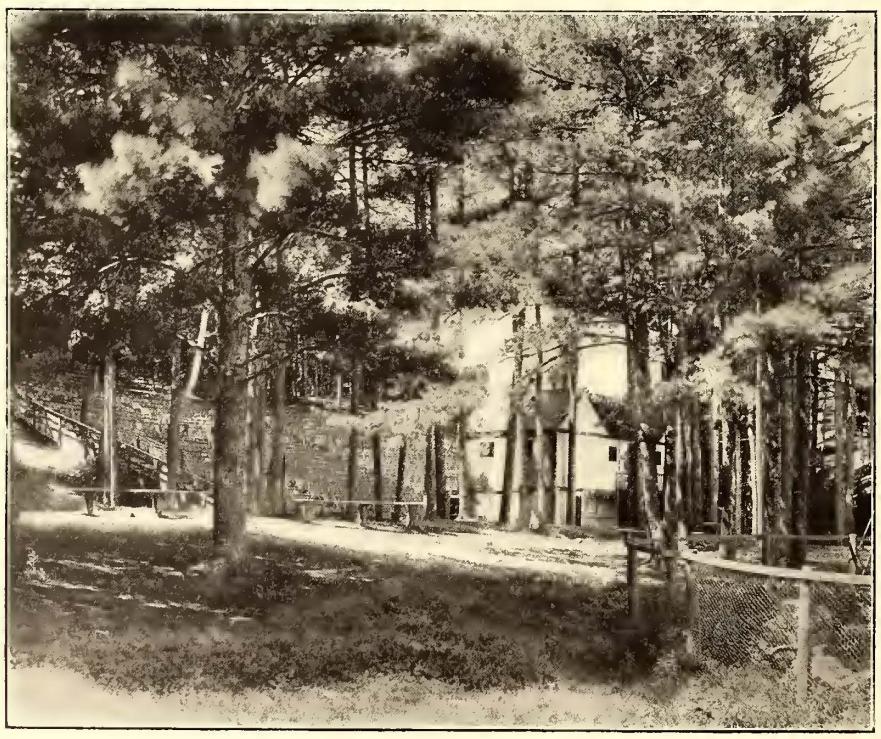
The problem of the conduct of their many parks is being taken up with renewed energy and vigor by the Boston & Northern and Old Colony Street Railway companies this year, as much encouragement was derived from the improvement made in the results last year over those of some of the years previous.

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.

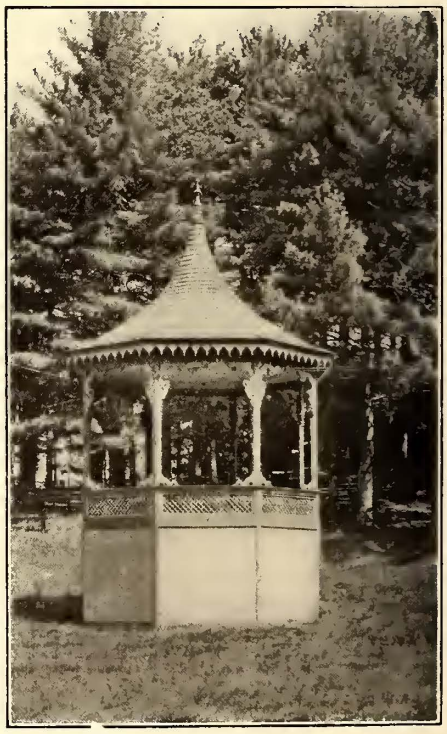
The seven principal parks are: Sabbatia Park, near Taunton; Highland Park, near Brockton; Lakeview Park, within 30 minutes of Lowell and 45 minutes of Nashua, N. H.; Glen Forest, near Lawrence; The Pines, near Haverhill; Long Beach, near Gloucester, and Westwood Park, near Dedham and an hour's ride from 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"



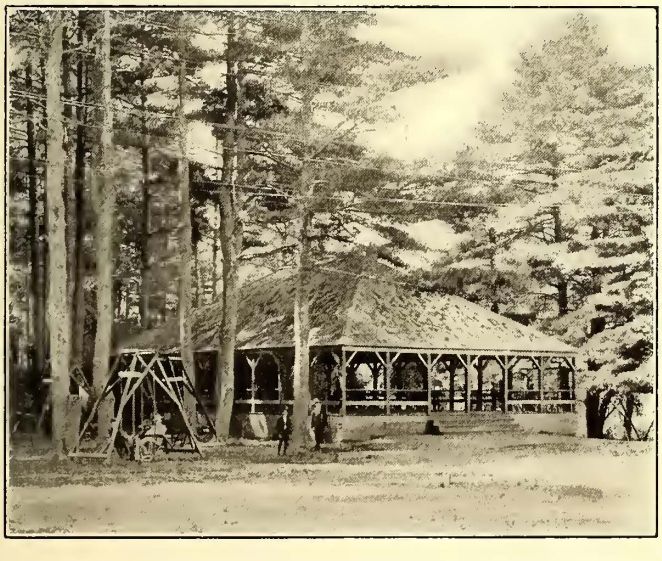
THEATER AT "THE PINES," HAVERHILL, MASS.



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.

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.

BIRD'S-EYE VIEW OF RAVINIA PARK, OPERATED BY THE CHICAGO & MILWAUKEE ELECTRIC RAILROAD

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.

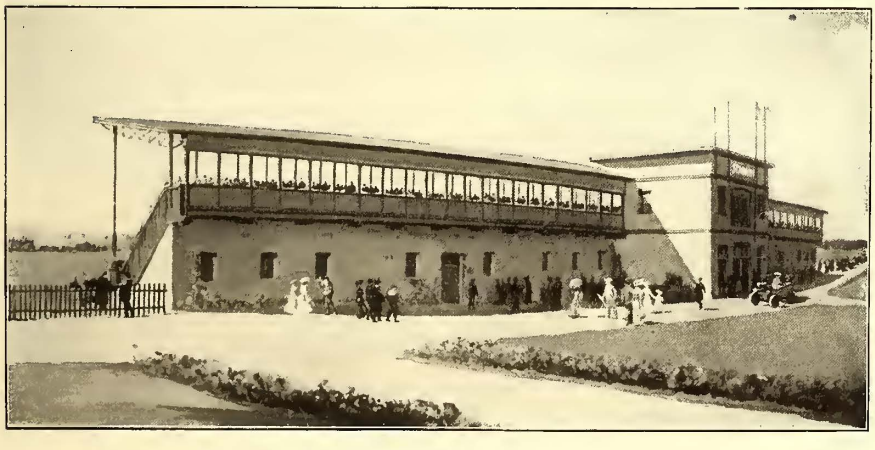
During the summer, various types of bands were used with more or less success. The principal trouble was to get one that could be heard above the continual thumping upon the floor by learners. A fife and drum corp were finally used with some success. During the winter, an Italian band of ten pieces has 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.



THE RAVINIA PARK STADIUM FOR OUTDOOR SPORTS

DUQUESNE GARDEN, PITTSBURG

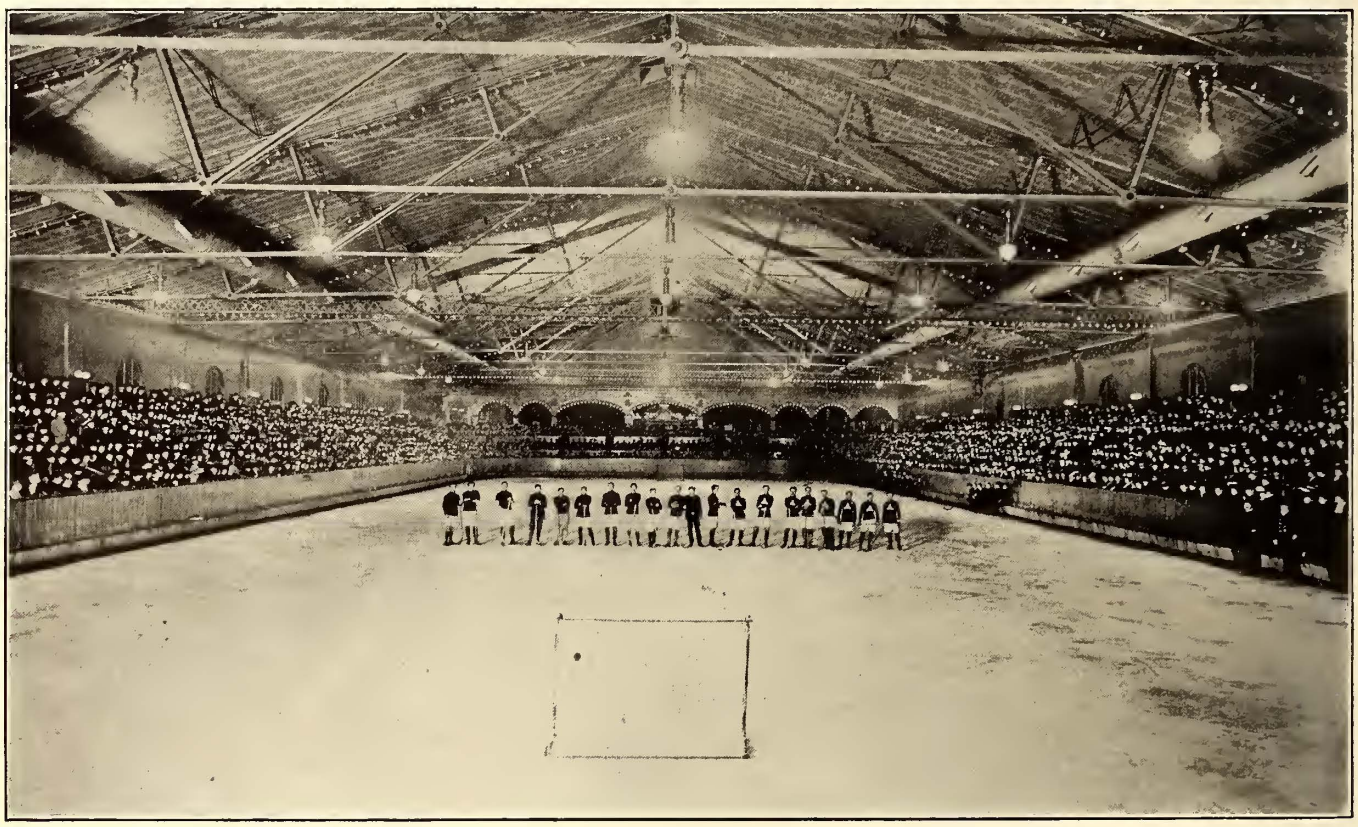
BY A. S. McSWIGAN,
Manager of Amusements and Advertising, Pittsburg Railways Company

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 Com-

pany, 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 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 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

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.

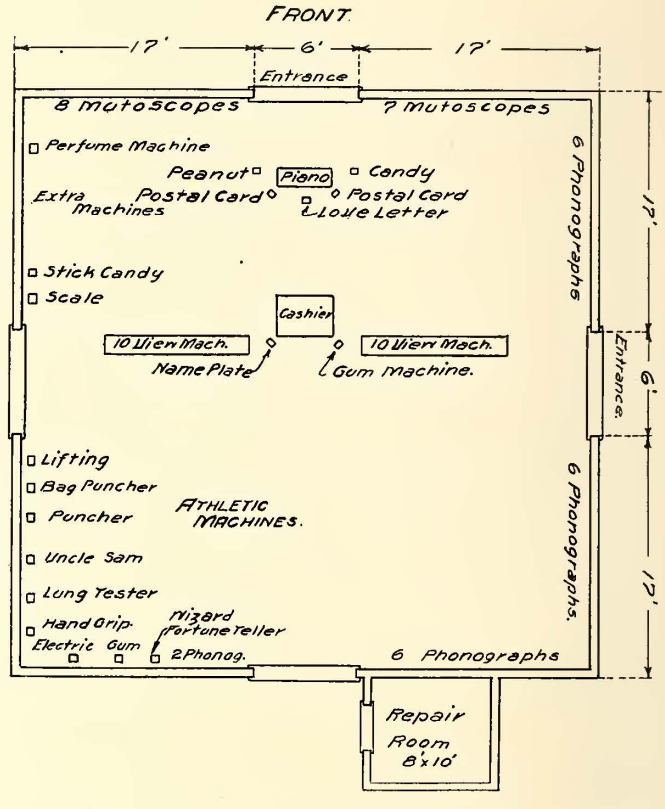
In starting an arcade, the first consideration must be location.

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.

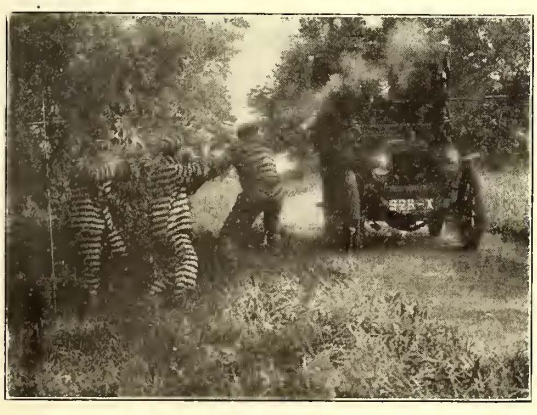
Everything must be absolutely clean and inoffensive in order to attract the intelligent and reputable public. The exhibition of vulgar attractions or catering to degenerates, means financial suicide. The rule should be: "Display that only

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.



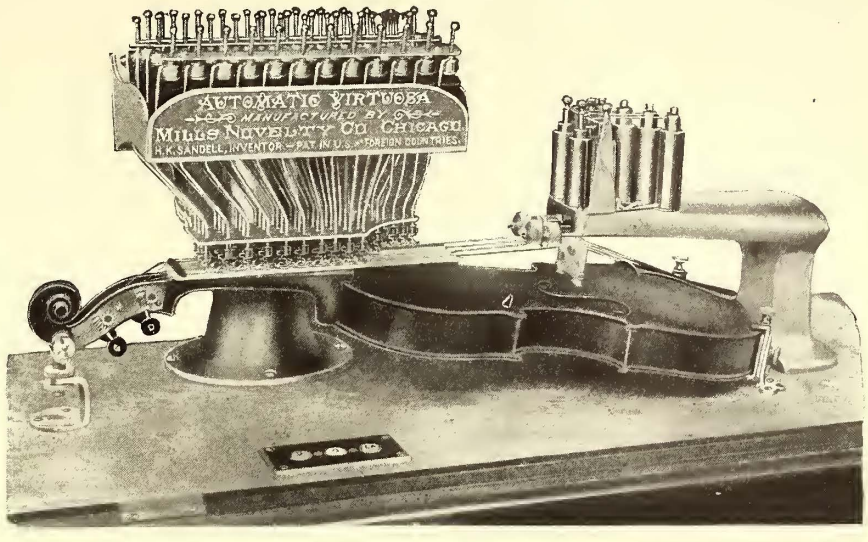
ONE OF THE VIEWS TAKEN TO PRODUCE "ESCAPED FROM SING SING"

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.

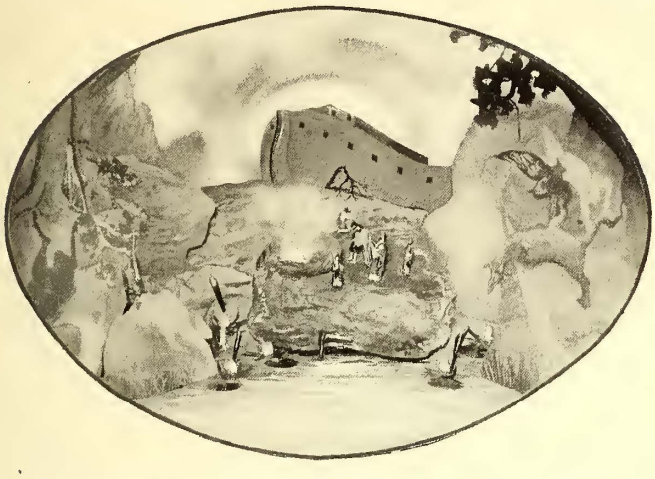
The marvelous success of this firm may be summed up in the following statement by E. E. Gregg, its president and general manager: "Park amusements to be popular with the masses and consequently profitable for the operator, must possess three requisites, viz., novelty, excitement and safety. You must 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."

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.

SPRINGBROOK PARK, SOUTH BEND, IND.

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.

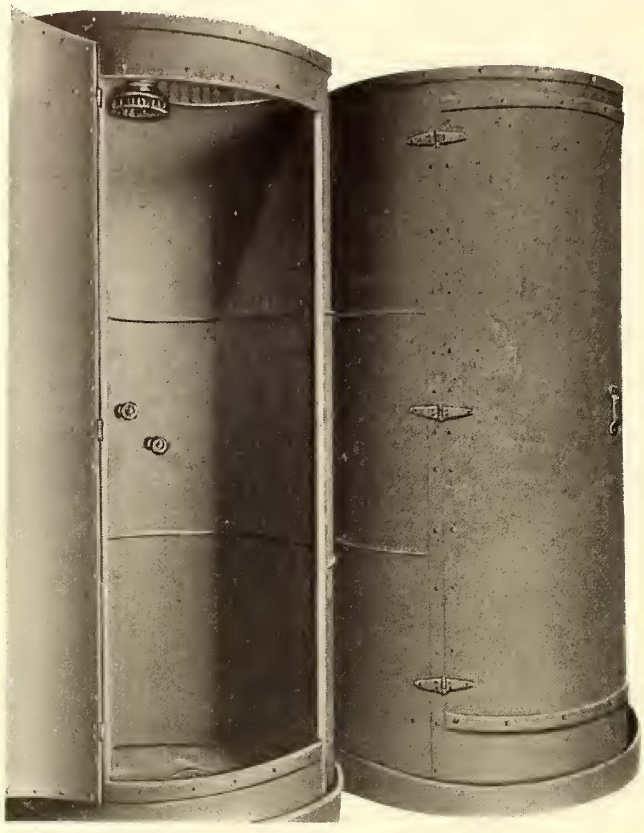
The fire started at 7:45 p. m. in a car which was over one of the repair pits on the most westerly track, about 100 ft. back in the house. Arrangements were being perfected to run the car out when the shoe, or plow, which makes contact with the underground conductors, in some way short circuited the 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.

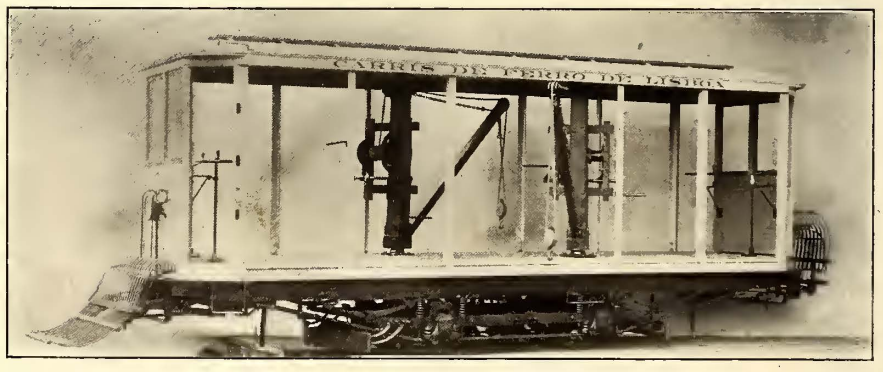
SHALLOW SUBWAY OPENED IN LONDON

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.

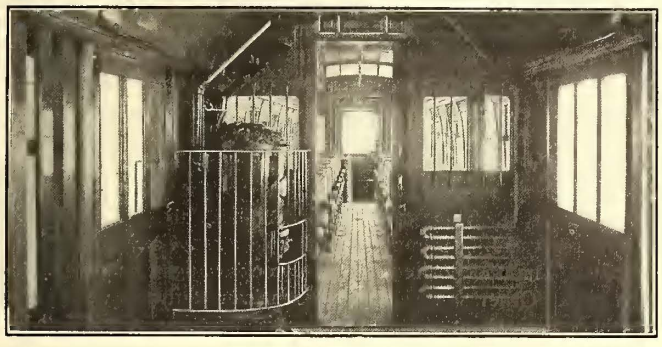


CONSTRUCTION CAR FOR USE IN LISBON, PORTUGAL

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

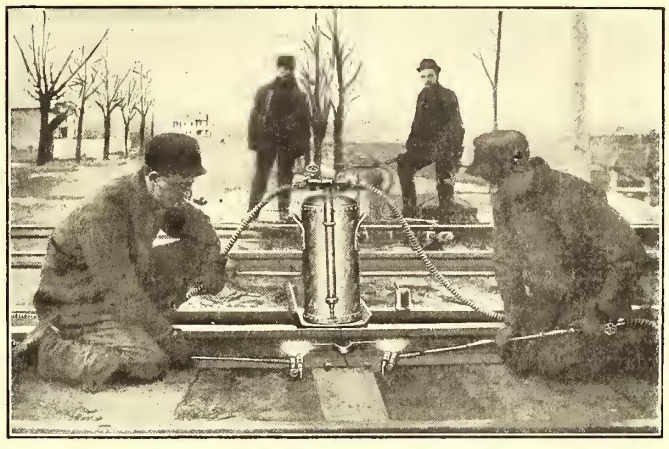
suited for such purposes, as it is located half-way between the terminals. Twelve cars have been in operation, all of which are arranged for baggage as well as passenger service.

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.

The bottom framing includes 15-in. x ⅜-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.

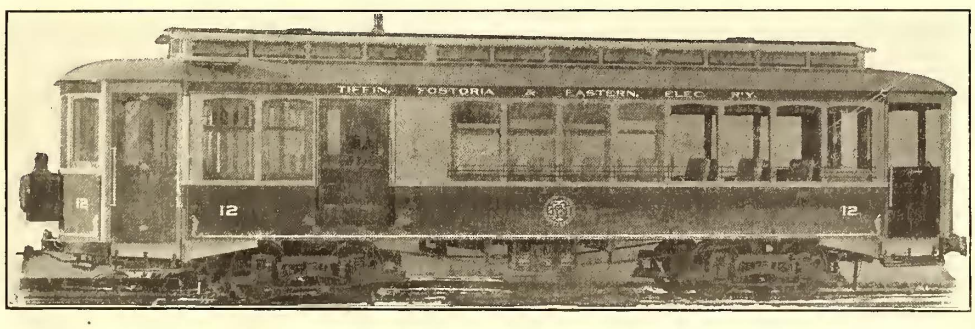
GASOLINE APPARATUS FOR SOLDERING RAIL-BONDS

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.



COMBINATION PASSENGER AND BAGGAGE CAR FOR THE TIFFIN, FOSTORIA & EASTERN ELECTRIC RAILWAY

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 50⅞ 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.