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Contents of this Issue

Great Variations in Trolley Wheel Wear

There is at present good opportunity for a profitable comparison of trolley wheel wear on high-speed interurban roads operating heavy cars, as such a comparison might result in a great increase in the mileage obtainable from trolley wheels in this service. We have previously remarked on the excessive wear on the trolley wheel on heavy high-speed cars. Inquiry among managers of interurban roads leads us to believe that there is much greater variation in the mileage being obtained from trolley wheels in this service than there should be. The average life of trolley wheels on the heaviest and highest speed cars varies on different roads from an average life of 500 to an average life of 5000 miles and more. There is evidently room for improvement on some roads, which can get useful pointers from others that have had better success with their wheels. The experience of practical men who have given this subject careful thought, would afford food for reflection, especially for managers of new interurban lines.

"Cure for Black Smoke—Electricity"

The management of the Long Island Railroad Company finds the requirements of the Board of Health for Queens County very exacting, and President Baldwin has declared that to comply with the regulations relating to the smoke nuisance would mean to stop the operation of locomotives within the city limits. The company has tried every known smoke consumer, he says, and has spent large sums in experiments, yet it is unable to bring about a satisfactory condition where steam locomotives are used. The road between Brooklyn and Long Island City and Jamaica will soon be operated by electricity, and it is probable that extensions will be made so as to include the entire system, as the management has reached the conclusion that the only sure cure for black smoke is electricity; in other words, the nuisance complained of can only be abated by eliminating the steam locomotives and substituting an electric system. Other steam railway systems operating suburban lines would do well to consider seriously the example set by this company and adopt a similar policy.

Real Rapid Transit

The Rapid Transit Commission has at last shown appreciation of the importance and magnitude of the problem of providing a real rapid transit system for Greater New York, and has instructed its engineer to prepare plans that will make adequate provision not only for temporary relief, but for future development on a scale worthy of the city. The general outline of the project, as formulated by Chairman Orr in his letter of instructions to Mr. Parsons, is printed elsewhere in this issue, and it is unnecessary to go into details here. We heartily approve of the determination of the commission to establish "a general and far-reaching system of rapid transit covering the whole city of New York in all its five boroughs." The work upon which the board is now engaged will be completed as soon as possible, and it is hoped that these measures will give temporary relief to a part of the city at least, but the subway now building, while it is destined to form an important part of the general plan, has always been recognized as a half-way measure by those familiar with the requirements of the city, and the extensions that have been proposed up to the present time were likewise inadequate, both in scope and direction. The decision reached at the meeting last week is the first step that has yet been taken in the direction of securing general and permanent relief, and this action was made possible only by the assurance that private capital would be forthcoming to put into execution the plans for such a comprehensive system. The significance of Mr. Belmont's offer to undertake the financing of this great public improvement will be appreciated by those who have given this feature of the problem careful attention. The city itself is precluded from undertaking the building and operation of adequate transportation facilities by the debt limit, and this has doubtless influenced the commission heretofore in confining its plans to such improvements as were absolutely necessary, and well within the scope of smaller operators. Now, however, that these restric-

tions are removed, the commission has promptly responded to the sentiment which has urged the earliest possible building of East Side lines and additional tunnels to Brooklyn, to bring that borough into more intimate connection with the centre of the city than could be done by any device of expensive new terminals or new bridges. Instead of stopping with makeshifts a complete system is to be built and every part of the city may be assured of consideration for its needs. This means a system of interborough communication which will enable the residents of Richmond, Brooklyn, Queens and the Bronx to go to any part of Manhattan in speed and comfort, and without change. The action of the Rapid Transit Commission at its meeting last week will go farther toward unifying the several boroughs of Greater New York than all the legislation that has been enacted upon that subject.

Our Friend the Automobile

In the palmy days of the bicycle trade there were prophets of evil who wrote down in the most lurid newspaper English a gloomy forecast of the fate that should come to all street railways that did not at once descend to the avenues of 3-cent fares. They wrote of the days when streets would be transformed into bicycle paths, and walking would become a lost art save in mountainous countries, and fear fell upon more than one street railway manager. Indeed for a brief season or two the wheel made material inroads upon the gross receipts of not a few electric lines, and it really looked as if trouble were brewing. But the days have come and gone and so has, for the most part, the bicycle as a common means of progression. And now the spectre of the automobile looms above the hozizon, but we doubt much whether it disturbs the dreams of any sane electric railway man. The goggle-eyed object in a leatheroid overcoat is not, as a rule, drawn from the ranks of street railway patrons. If anything he will help traffic by rendering pedestrianism what the accident insurance companies would reckon an extra hazardous risk. With automobiles at their present or any plausible future price they will not be a favorite with the workingman. But how about automobile omnibus lines and the magnificent possibilities that the industrious promoter puts up for them? Are our trolley lines to run empty cars while the public automobiles spin merrily by, bearing full loads of scoffing citizens? We have not yet reckoned up the list of the defunct, but the dead and moribund public automobile companies are sufficient to fill a sizeable private graveyard. The conditions of public service seem to be unhealthy for them, and while they are not yet fairly out of the experimental stage we have no definite assurance that they ever will be. So we do not feel that electric railway building need stop on their account just yet, nor that the big traction companies will have to pass any dividends for lack of patronage. If public automobile 'buses can suppress the metropolitan cabman they will do a noble service, but they will have to cut down their repair bills before they can tackle the street railway.

Anthracite Coal Situation

Managers of street railway properties are vitally interested in the miners' strike, as a prolonged struggle would not only exhaust the present supply of anthracite coal, but would soon seriously tax the capacity of the bituminous mines. The present controversy has created an anomalous condition which may be briefly stated as follows:

Organized labor brought about the strike of the anthracite coal miners, and this resulted in a scarcity of hard coal, making it necessary for many power plants to burn soft coal under their boilers, temporarily at least.

Organized labor then turned to the health board and demanded that the laws pertaining to the smoke nuisance be strictly enforced, which means, in effect, that the burning of soft coal shall be prohibited.

Now, we have no fault to find with the dissatisfied miners who quit work. They were acting well within their rights, and as long as they were not satisfied with their condition they were at liberty to leave singly or in a body, and as long as they conduct themselves in an orderly and law-abiding manner they will be entitled to the respect of the community. But, when, through their allies, they seek to use the courts to further their ends by demanding the enforcement of laws which they have made inoperative, they turn their movement into a burlesque and make themselves ridiculous in the eyes of all men.

We do not believe that they will get much sympathy in their crusade against the "smoke nuisance," but, assuming such a condition possible, what would be the result? Every power plant in New York would be forced to shut down, shops of all kinds would be closed, and the transportation companies would have to suspend operations. This condition would be duplicated in every city of the country where anthracite coal is burned in power plants. Who would be the real sufferers through such a policy? Undoubtedly the wage-earners, the men responsible for this condition. Of course capital would suffer, too; there would be heavy losses, some failures and many sacrifices, but the chief suffering would be among the laboring men, and they would find little consolation in knowing that their employers had sustained heavy losses. Such a policy could not succeed; the means would react and defeat the end sought; the methods would make enemies and cripple friends, and create conditions that would become intolerable. And when it is reflected that the individuals and corporations against whom the present movement is supposed to be directed would be the least affected, the injustice of the whole scheme is manifest. We look for an early settlement of the controversy, and we hope that it will be satisfactory to all concerned.

Ten or a dozen years ago a miners' strike would be a matter of perfect indifference to the street railway interests, but the times have changed, and to-day it is a vital question with every road in the country.

Texas Oil Boomers

Press reports have been assiduously circulated during the last few weeks, and have found their way into the columns of financial journals, announcing that crude oil had been adopted by certain street railway companies for fuel, and that hereafter it would be burned under the boilers in many large plants. One of these announcements came from St. Paul, under date of May 8, and was published in the leading newspapers throughout the country. It intimated that experiments had been undertaken by the Twin City Rapid Transit Company because of the trouble that company had had with the Health Department on account of the smoke nuisance. The report announced that "the company is now equipping its six boilers at the Hill Street power house with fuel-oil burning grates." In order to give this statement an air of authority the details of the arrangement alleged to have been adopted were very fully explained, and it was asserted that "crude oil will be used for fuel by the railway company in every one of its power houses. There will be no smoke, and the use of stokers will be dispensed with. The St. Paul Gas Lighting Company, which also uses a part of this station, will equip its boilers with the same appliances."

An effort to verify this report and gain additional information led to the disclosure that the statements contained in the press dispatches were entirely unwarranted by the facts, and that like most of the statements emanating from the oil boomers' press bureau they were intended really to create a false impression among investors regarding the present market for this product, and mislead a gullible public into buying stocks in oil companies. The facts briefly stated by General Manager Willard J. Hield, of the Twin City Rapid Transit Company, are as follows:

> Some of the Texas oil people have shipped in and we have agreed to burn two cars of fuel oil. The company is experimenting with it, but has reached no definite conclusion.
>
> There is no probability that we would use oil regularly unless freight rates were changed materially, and we have no particular interest in the consumption of this except as a matter of accommodation to the agent who shipped in without consulting with us and who is anxious to get the stuff off his hands.

Of course such methods are reprehensible, and stamp the enterprise employing them as unworthy of public confidence. The time may come when power station managers will adopt crude oil for

fuel, but conditions will have to be changed materially and the relative cost of oil and coal will have to be reversed. Progress toward this end will not be made by the circulation of such false reports as those alluded to in this article. They will really do much harm, as they will create suspicion in the minds of those who might become interested in the subject if the work was conducted along legitimate lines.

Combination Power Stations

In the archaic period of electric railroading, ten or a dozen years ago, it was not uncommon practice for small railways to buy power of neighboring lighting stations, either directly as electric power, or by attaching their dynamos to the lighting company's shafting. Some such contracts based on the car mile reckoning are in force even at the present time, although most of them have expired or have been cast out with an accompaniment of blue lights and a smell of brimstone. What little renting is now done is mostly from hydraulic transmission plants. It has seemed in other cases to lead to vexation of spirit. But still there is something to be said for combination stations since it is a well-established fact that small stations can be operated only at a rather high cost. However, it seems to us as though the earlier practice was generally open to the objection of compelling the tail to wag the dog. Why should not small electric railways oftener turn an honest penny by supplying lights and power along their lines? Many a road is operating a small and inefficient station for railway service only when there is a fair field for lighting and power service scattered all along the line. The steam plant is there, and sadly underloaded most of the time; the main pole line is there and far from being overburdened with wires, and the market is steadily growing, for population follows the trolley. If permission can be obtained from the local authorities it ought to be possible to improve the load of the station and pick up remunerative business to a considerable amount yearly at a very moderate outlay. Many a small road would be glad to pick up a few thousand dollars a year additional income, and many a community would be glad enough to get electric light and power.

It is obviously not a procedure desirable for all roads in all places, but there are many instances in which it could be done to advantage. Not all roads are destined to become great trunk lines, whatever their promoters may hope for them, and many a station has steam capacity that could thus be put to good and profitable use. Of course our worthy contemporaries, the underwriters, would get up on their hind legs and bray with distress at the mere suggestion, that at some future time in some undetermined spot a power motor might be run from a railway circuit. But it is not at all necessary to put electric motors on the floor and pile shavings around them. To work an occasional machine off a railway circuit is certainly no more troublesome from the standpoint of safe installation than to operate the high-voltage constant-current systems which are used to a considerable extent abroad. It is easy enough to build a fireproof dog kennel for a motor, and to run a few feet of shafting to get at the work, even if no better means were available, and in these days of polyphase distribution, motor service need not be from the railway feeders at all unless convenience rendered it desirable. Even ten or a dozen motors of moderate size would make a perceptible addition to the net income of a small road, and in a small community the motor peak is likely to be passed before the railway peak is at its highest, so that the extra load would come at a time when it could readily be handled. As to lighting, of course special circuits would have to be run for most of the work, but some useful public lighting could be effectively done by groups of enclosed arcs or similar grouping of incandescents. Now and then work of this kind is done, but the small station seldom takes up the matter seriously. A given amount of energy brings a far higher net price when used for lighting than when applied to any other purpose. Obviously few small electric railway stations could take on an all-night service without inconvenience, although in the cases where a small combination station would be most useful, all-night service is less important than elsewhere. At all events there seems to be a good chance for an occasional combination station, particularly in scattered communities, and we should be glad to hear of results from any places where the experiment is being tried.

Short-Sighted Policy

The attitude of railroad managers generally upon the question of substituting electricity upon their suburban lines for the present steam locomotives is reflected in the statement of a prominent official recently that "the chief obstacle in the way of such a plan is the fear that if the idea were carried out the next thing would be a reduction of fares, by order of the Legislature." This explanation is unworthy any man who is competent to direct a large corporation, yet it has often been advanced, and is undoubtedly the only reason for the delay in the electrical equipment of many lines that are now operated by steam. It is surprising that the managers of these lines do not see what is patent to every one else. Their lack of progressiveness furnishes opportunities for others to establish lines conforming with modern ideas. The demand for cheap transportation and better accommodations cannot be satisfied by such a policy as indicated by the steam railroad managers already quoted. Competition is inevitable under such conditions, and considerable financial loss must be sustained by the established road in retaining its supremacy when it is fortunate enough to do so. But in the end the demands of the public must be met, and no matter how long the delay or how grudgingly given the improvements are bound to come. Under the circumstances, therefore, it would be wise for the steam railroad manager whose views have been presented, and for all others similarly situated to reconsider their determination and adopt effective measures for granting the improvements sought before they are confronted with rival lines, which are better equipped for the service, and will therefore appeal more forcibly to the public for patronage.

London Omnibus Trust

Warned by the success of the Americans who have invaded the the London traction field and those who have engaged in other electrical enterprises, we are told that the London omnibus companies, three in number, have combined in order to present a solid front against all possible rivals and to forestall the possibility of Yankee competition. The omnibus business has been an extremely profitable one in London, and the present owners are loath to release their grip upon it, nor will they consent to the introduction of much-needed improvements. All omnibus lines, where animals are depended upon for propulsion, are an abomination to-day, but those of London surpass anything offered on the continent of Europe. Everywhere Americans complain that the 'bus service is slow and tedious, but that of London is pronounced beyond endurance by those who have enjoyed the advantages of modern electric railways. Horses are continued in service on these lines long after they have passed the age when they should be entitled to retirement, and consequently the 'buses, which are themselves ramshackle vehicles as a rule, lumber along through the crowded thoroughfares, making very slow progress; in fact, it is not difficult to outstep one of them under ordinary conditions, for while the pedestrian goes steadily on the 'bus stops frequently to allow passengers to alight or enter. An hour and forty-five minutes is considered tolerably good time for covering four miles. This fact of itself would seem to preclude the possibility of any serious competition being offered by the "trust" to the electric railways which are now being built as a result of the infusion of American capital and American engineering into the English metropolis. With the opening of the electric systems on the underground railways and the equipment of the trolley lines it would seem that there would be very little excuse for a continuance of these antiquated vehicles. We believe that they are too much even for English conservatism, and that they will now be relegated to obscurity.

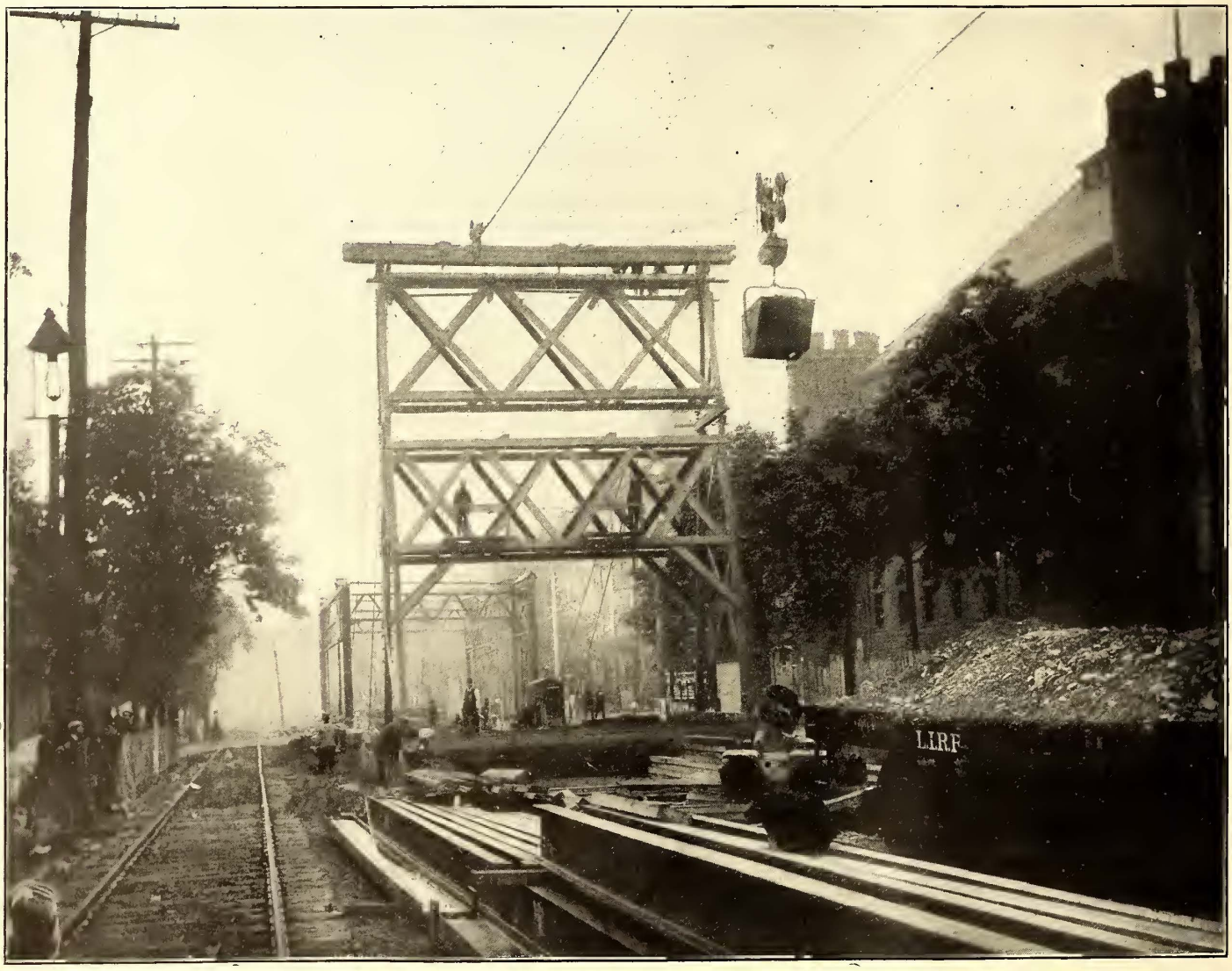
Improvements on Atlantic Avenue, Brooklyn

The Long Island Railroad Company, which, for a number of years, has had its tracks in the middle of Atlantic Avenue, Brooklyn, is about to make great improvements in that part of the road which enters the city. Within two years the monopolizing of the street will be a thing of the past, and instead trains on the Long Island Railroad will reach what is now the terminal station at Flatbush Avenue by means of a series of viaducts and tunnels.

The Board for the Atlantic Avenue Improvement commenced reorganizing the traffic conditions on Atlantic Avenue the first part of last December, and the present condition of the work is shown in the accompanying engravings, which are made from photographs taken in the vicinity of Bedford Avenue. The general plan of the Board has been to follow in part the requirements of the contour of this part of the city, tunneling through the hills and building elevated structures on the depressed portions. This method is, of course, less expensive than if a deep tunnel had been constructed over the entire route. From the Flatbush Avenue station to Bedford Avenue the road passes through a double-track tunnel, emerging at Bedford Avenue, and by means of a gradual incline of masonry reaching a viaduct which continues until Ralph Avenue, where the tracks are again placed underground. This second tunnel extends to Stone Avenue. From Stone Avenue to Atkins Avenue the road will consist of a four-track viaduct, and beyond Atkins Avenue it will run on the surface. It is expected that freight trains will use the viaduct as far as Stone Avenue.

In authorizing the board to make these improvements it was expressly stipulated that some other power than steam should be used for propelling the trains. By the time the improvements are completed, therefore, it will be compulsory on the part of the Long Island Railroad to operate its cars by such motive power, which, of course, will be electricity. At present nothing has been definitely decided as to what the distribution system or the type of rolling stock will be, but it is probable that before many years the power for this section of the railroad will be obtained from a large central generating station, whose location is to be decided upon, and that trains will be run, consisting of motor cars and trailers, operated by the third-rail system. Before the main power station is built it is possible that temporary stations may be constructed to supply immediate needs of the road.

The tunnel will be rectangular in cross section, and will in all parts be constructed by excavation from the surface. The roof will consist of transverse I-beams, with arches between, and will be but a few feet below the surface of the street. The floor of the tunnel is formed of concrete and slopes toward the center, making a shallow trough. The thickness of the concrete at the middle is about a foot, and it increases in thickness as it approaches the sides. The side walls are of masonry and contain conduits for the insulation of the electric feeders. There are thirty-two ducts on each side, and manholes for the introduction of the cables will be placed at regular intervals. These manholes will be of the ordinary double-cover type used for electric conduit work. The tunnel will be ventilated by gratings, 3½ ft. x 4½ ft. in size, placed at intervals of 30 ft. Directly under these gratings is a platform, which serves as a trap to prevent any drainage from the surface entering the tunnel. The air passes around this trap freely. The track will be laid on gravel ballast, placed directly upon the concrete floor of the tunnel.

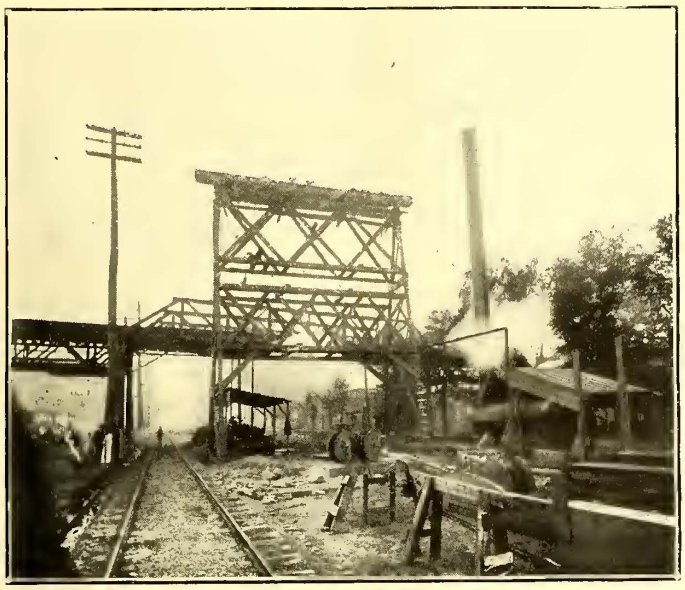


EXCAVATING THE ATLANTIC AVENUE TUNNEL FOR LONG ISLAND RAILROAD

In general the elevated structure is to be made of heavy plate girders with tracks above. Wooden ties are fastened directly to the tops of these girders and rails attached to the ties by spikes. In portions of the work, especially near the end, where the elevated structure approaches the inclines and there is lack of sufficient head room, trough construction is used, the longitudinal girders being here above the tracks. In this part of the work the ties will be imbedded in asphaltic cement on the floor of the trough. The structure will be supported upon posts made of I-beams and channel irons placed upon concrete foundations. The

channel irons are riveted to the flanges of the I-beams with the convex sides out, so that the general outline of the column's cross section is square. Cast-iron caps will be placed around the bases of the columns. All the work on the viaduct will be extra strong, providing for the heaviest traffic that is ever likely to occur in this district.

At the terminal station at Atlantic and Flatbush Avenues there will be a basement in which ingress and egress may be had to and from the trains. The tunnel for the present will stop at this point, but future developments of the rapid transit situation in New York



STRUCTURE AT END OF CABLEWAY

will probably consist in building an extension under the East River to Manhattan. The jurisdiction of the Board for the Atlantic Improvement, however, ceases at Flatbush Avenue, and from there on the problem must be handled by the Rapid Transit Commission. At present all the indications are that before many years there will be a tunnel from the Battery, which will have its termination at the Flatbush Avenue station, joining at this point the tunnel now under construction. At present the Long Island trains use the elevated tracks of the Brooklyn Rapid Transit Company, which leave the Fifth Avenue branch at Atlantic Avenue, and after a few blocks descend by grade to the surface. When the tunnel is completed this grade will be extended so that the tracks will go below the surface and enter the tunnel. The work of construction is in charge of W. M. Meserole, general superintendent of the Board for the Atlantic Avenue Improvement.

Interurban Line for Western New York

Plans are being prepared for an electric railway line between Buffalo and Rochester, and it is now believed that this long-cherished project is in fair way of accomplishment. The Buffalo & Depew Railway has filed an extension with the Secretary of State and local boards from Depew to Rochester, passing through the villages of Lancaster, Looneyville, Crittenden, Corfu, West Batavia, Batavia, Stafford, Leroy, Caledonia, Mumford, Garbutt, Scottsville, Brookdale and Maplewood to Rochester. This will bring it into direct competition with the New York Central system, as the proposed line will parallel the old "Buffalo Road," between Buffalo and Batavia. East of the latter point, however, it will follow the line to Syracuse as far as the Western New York & Pennsylvania Railroad Junction, and thence proceed northward to Rochester.

The Buffalo & Depew Company now controls and operates the line running from the end of the Genesee Street line of the International Traction Company, of Buffalo, to Depew. It is a double-track, stone-ballasted roadway, built for high speed. The extension to Rochester will also be built for high speed. The surveys for the road are now being made, under the direction of George A. Ricker, engineer in charge. The legal matters in connection with the establishment of this line are looked after by Herbert P. Bissell, of Buffalo, and the preparations for construction of the line by John T. Mooney, superintendent of the Buffalo & Depew Railway. It is announced that the plans and matters pertaining to the right of way will be closed up very shortly so as to allow the work of construction to be pushed during this summer.

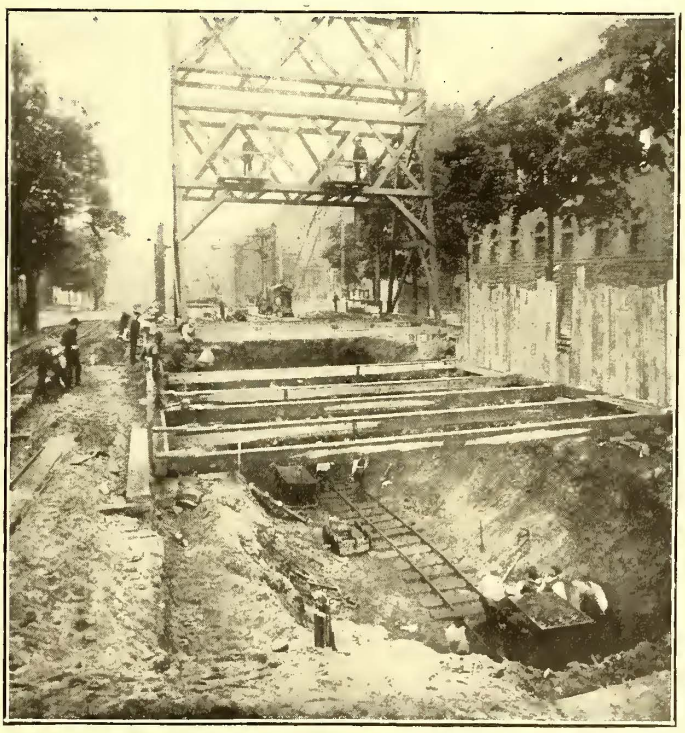
The route selected for this road is through one of the most populous sections between Buffalo and Rochester. It is one of the most attractive portions of Western New York, and the summer travel alone should prove profitable. The Buffalo & Depew Railway is controlled by The Investment Company, of Philadelphia, whose office is in the North American Building, Philadelphia. D. A. Hegarty has personal charge of this work.

Varnishing Cars Yearly

H. M. Sloan, the general manager of the Calumet Electric Street Railway Company of Chicago, has been making a comparative study of methods of taking care of car bodies, with particular reference to painting and varnishing, and he has arrived at the conclusion that it is much better and more economical to put a coat of varnish on a car every year than do nothing to it for several years in the expectation of repainting it entirely at the end of several years. Cars operating in the same kind of service in the same territory for several years show the difference in the two methods. The additional coat of varnish each year seems to preserve the colors underneath, and except for a slight cracking, visible only on the closest inspection, the varnish is not noticeable for its thickness, even after five seasons' repetition of the varnishing process. Of course there is a limit to the simple varnish treatment, and there comes a time when the paint must be burned off. In the meantime, however, the cars have been kept in a much more presentable condition than if there had been nothing done with them and the day of necessary painting has been put off several years. In painting and varnishing, as in other matters, the principle of "stitch in time saves nine" seems to hold.

Electric Trains over Steam Roads

An interesting feature of the proposed railway between Denver and Salt Lake City is the plan to run trolley cars over the same road on the first branch to be constructed, namely, from Arvoda to the Coal Creek mines, a distance of 10 miles. Three 80-lb. steel rails will be laid, the outside rail making the track of standard gage. The other rails will make a 3½-ft. gage, to cor-



AT WORK IN THE EXCAVATION

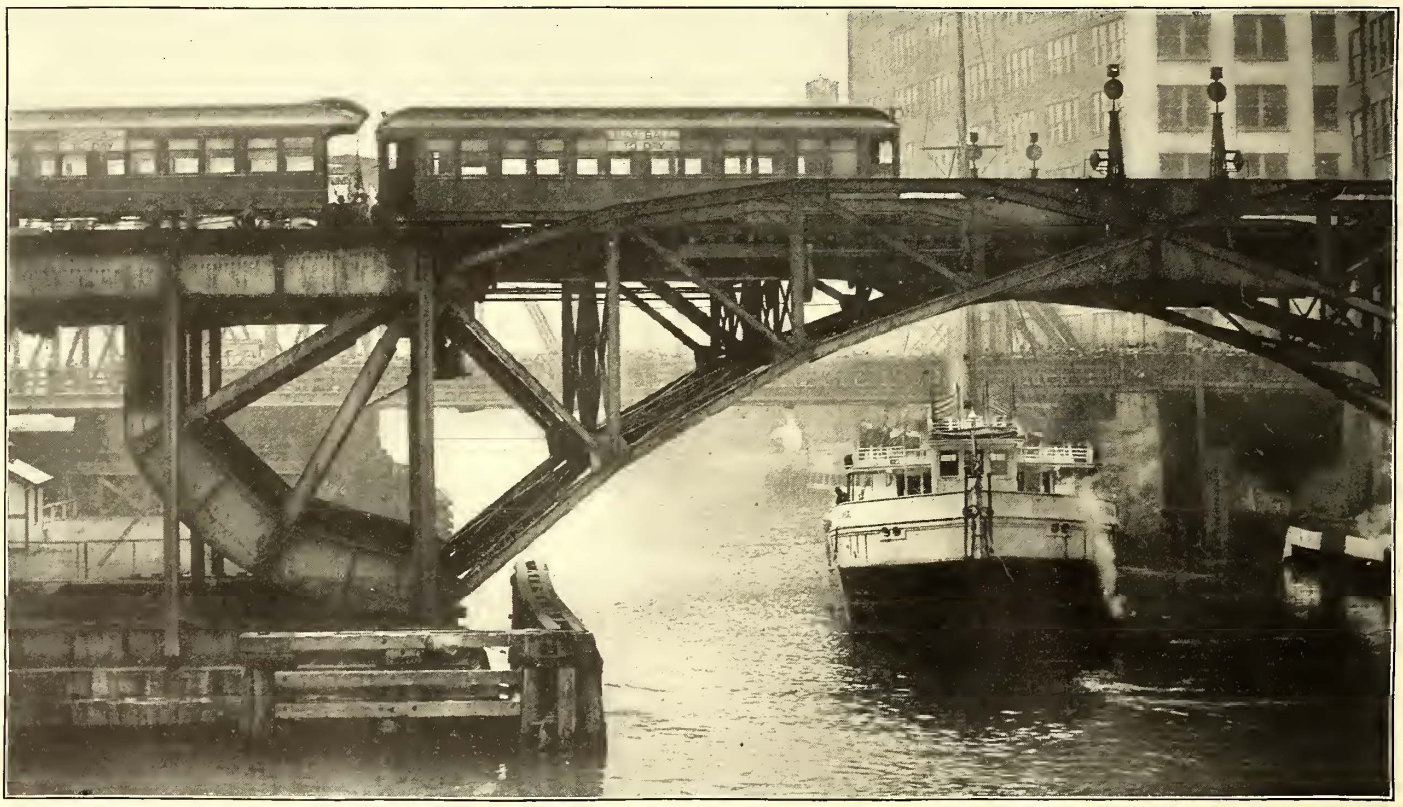
respond with the width of the trolley lines in Denver. The overhead trolley system will be used, and the trolley wire will be strung 22 ft. above the roadbed, allowing ample room for steam trains to pass underneath. It is proposed to obtain electric power from a large plant, to be located in Denver. The project includes the building of three electric roads to be run from Denver, the first extending south to Littleton and Platt Canyon, the second in the direction of Golden to Lookout Mountain, and another to Brighton City and towns north of Denver. It is believed that the advantages of steam railroad construction will enable the company to give superior electric service.

Depot for Interurban Lines at Cincinnati

Ground has been purchased at Cincinnati for the erection of a union depot for the interurban lines that are to enter that city, and the Interurban Terminal Company, capitalized at $100,000, has been incorporated to provide the necessary terminal facilities. The depot that is to be erected is to be six stories in height, and there will be trackage on the ground floor sufficient to accommodate four or five cars, though it will rarely be the case that there will be that many at the terminal at one time. On the second floor there will be offices of the various roads and also of the terminal company. The other floors will be used as storerooms and for the handling of freight. Primarily the interurban station is to be built to accommodate the lines of the Rapid Railway Company, the Suburban Traction Company, and the Cincinnati & Eastern Electric Railway Company, all controlled by the same interests; but the other companies operating to Cincinnati will be given the right to use the station.

Accident on a Chicago Lift Bridge

A peculiar accident took place recently on the four-track rolling-lift bridge by which the Metropolitan West Side Elevated Railway, of Chicago, crosses the Chicago River. About 5:30 p. m., May 15, a motorman disregarded the danger signal at the approach to the bridge and ran on to the bridge just as the bridge-tender started to raise the draw. The motor car almost reached the end of the draw, but was prevented from running over the end by the incline which the draw had assumed. There was a crushing of platform hoods because of the angle to which the motor car had been raised, and derailment of the front car, as it ran back down the incline, but no other damage. During the several hours necessary to remove the wrecked cars traffic both on the river and across the bridge was of course suspended. The accident demonstrated strikingly the desirability of the rolling-lift type of bridge for locations such as this. With a revolving draw the whole train might have landed in the river. As the bridge is near the entrance of the Metropolitan elevated to the Union loop, those trains on the loop were compelled to remain there, but to prevent delaying the trains of the South Side Elevated Railroad, which uses the same tracks as the Metropolitan on the loop, the Metropolitan trains were kept running around and around on this section until the bridge tracks were cleared. The accompanying engraving from a photograph, by S. E. Wright, of the Chicago *Inter-Ocean*, shows clearly the situation on the bridge immediately after the accident.



THE DAMAGED TRAIN AFTER CHICAGO DRAW-BRIDGE ACCIDENT

Trolley Lines near Trenton, N. J.

May 22 was the tenth anniversary of the introduction of electric railways into Trenton, N. J., and the accompanying map shows what proportions these properties have now assumed. The beginning of the street-car service in Trenton was on March 9, 1859, when the New Jersey Legislature incorporated the Trenton Horse Railroad Company, which ran its first car some three years later. From that day to 1892, or nearly a third of a century, the only improvement noticeable in the street railway service was the substitution of double-ended cars for the old bobtails, and the general changing from long-eared mules to horses. From May 22, 1892, to May, 1901, the Trenton Street Railway Company and its predecessors had the city and suburbs entirely to itself, no outside line invading the precincts.

It is interesting to compare the history of the first thirty odd years of the road with that of the last decade. When the Common Council of the city, on July 28, 1863, passed an ordinance limiting the speed of the horse cars to six miles per hour, requiring that a loud-sounding bell be rung before each street was crossed, and prohibiting the running of cars on Sundays, it was felt by the good citizens of the State Capital that a great situation had been fairly met and disposed of for a long time to come. The little single track line which ran from the Clinton Street depot, on the Pennsylvania Railroad, to the center of the city was extended to a point just west of the State House, and it was felt that to push farther westward would be to invade a rural district, which might forever remain untouched by the wheel of a street car. For twenty years the single track carried all the volume of traffic which swept over it, and it was regarded somewhat in the light of taking time by the forelock when the Trenton Horse Railroad Company secured permission, in 1883, to double track the line from the depot to the center of the city. As years passed by the citizens of other sections of the city felt that street railways were not a thing to be despised, and the City Railway Company sprung into existence in 1876, constructing a line from East Trenton, or Millham, as it was then known, through North Clinton, Perry and Broad Streets, crossing the opposition track in front of the City Hall at right angles. The invasion of that part of Trenton lying south of the canal, known then as the City of Chambersburg, by the City Company, led the older corporation to run its line down Clinton Avenue, and this led to a rivalry which soon gave Chambersburg a very complete system of horse car lines. When the electric cars were run some of these lines were abandoned, because of their crossing other lines where traffic was light or paralleling within a block.

In September, 1891, Colonel Lewis Perrine, Jr., consolidated the

two horse car companies, under the name of the Trenton Passenger Railway Company, and this has since been changed to the Trenton Street Railway Company. Colonel Perrine had advanced ideas about the street railway service, and he at once began the work of equipping the East Trenton line with trolley wires, and secured cars, which were put into service on May 24, 1892. The first car was run at 11:30 p. m. on May 22, this late hour being chosen because of the deserted condition of the streets and to guard against exhibiting in daylight any unforseen antics of which the equipment might be guilty.

From 1892 to 1894 there was but little extension of the trolley system in the city, the only parts equipped being the Broad Street and Center Street lines. After a long battle with the City Council and the Board of Public Works, the latter body having since been legislated out of existence, consent was secured to extend the electrical equipment to the State Street and other lines, and work was begun on the former, shortly after midnight, one night in April, 1894. Some of the fashionable residents of the West End, who had fought the installation of the trolley, continued the fight during the small hours of the morning, but without avail, so that by daylight, despite all obstructions interposed, the company had cars running out State Street, from the center of the city to Calhoun Street, over the old horse car tracks. Litigation delayed the completion of the road for a few weeks, but the horse car had become a thing of the past in Trenton.

During the seven years that followed the abolition of the horse car the Trenton Street Railway Company extended its Broad Street line to White Horse and Yardville, and to Princeton, the former line being five miles long and the latter twelve.

In 1899 connection was first made at White Horse, two miles south of the city line, with what is now the Camden & Trenton Railway, for Bordentown and White Hall. The Camden & Trenton was extended into the lower end of the city last May, paralleling the Trenton Company's line for nearly two miles. During last year the Camden & Trenton road was extended from White Hill to Burlington and Riverton, from which place it runs its cars to West Palmyra over the tracks of the Camden & Suburban. The distance from Trenton to the present terminus is twenty-five miles, and from there to Camden about eight more. Part of this break already has a section of the Camden & Suburban covering it, and it is expected that the line will be completed sometime this summer. In the summer of 1900 W. F. Sadler, Jr., a trolley and railroad promoter, came to Trenton and began work upon the Trenton, Lawrenceville & Princeton Railroad, over a private right of way, and for all purposes that a steam road could be used. It was not equipped for trolley service, and was completed only to Stony Brook, a distance of ten miles from Trenton. A locomotive was purchased and occasional carloads of freight were hauled over the line during the winter of 1900-01.

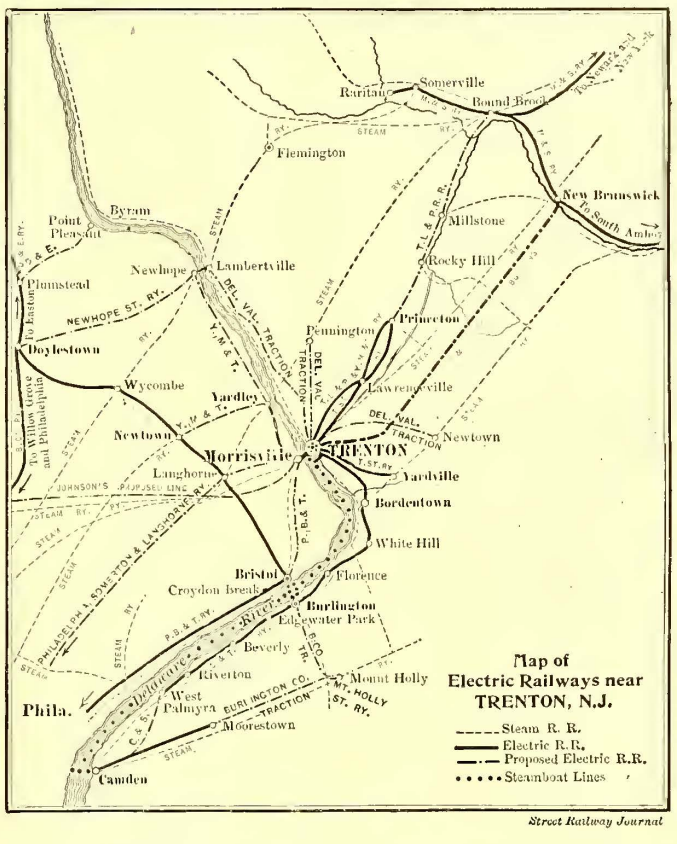
In the spring of 1901 the late A. L. Johnson came to Trenton to look over the field, with a view to making this city a way station on his proposed through line from New York to Philadelphia. He entered into an agreement with Mr. Sadler and others of the company and secured the road. Contracts were at once let for the erection of a large bridge across Stony Brook, and a two-mile extension into Princeton. The road was electrically equipped during the summer and a temporary power house constructed at the Trenton terminus. The first car was run in November, 1901, and at the present time the equipment consists of three large eight-wheel coaches, fitted with all improvements, including air brakes, whistles and arc headlights; one eight-wheeled baggage car and a locomotive. An hourly schedule is maintained between Trenton and Princeton. Single cars are used, and they make the twenty-four miles in an hour, including the layovers. Trips are made from 6 a. m. to 12 p. m. from the Trenton end, and the fare for the twelve miles is 10 cents. The Trenton Company operates three large cars on its Princeton division, but as the line runs mostly along the public road, the time for a round trip is two hours from the center of the city. The fare is 15 cents each way, but six tickets, which cost 25 cents, will take a passenger the round trip, and free transfers are given to any part of Trenton, making the net rate about 8 cents, if transfer is used.

While Mr. Sadler was building the Trenton, Lawrenceville & Princeton Railroad he also began the Yardley, Morrisville & Trenton Street Railway, which was to extend from the Morrisville (Pa.) end of the upper Delaware bridge to Yardley, a distance of about five miles. This road was in operation during the winter of 1900-01, and was sold to the Johnson syndicate shortly before the Trenton, Lawrenceville & Princeton Railroad. The new owners purchased the upper bridge for a price which ran well up toward $200,000, and extended the Yardley line into the city of Trenton. Property was purchased at the corner of West State Street and Calhoun Street (where the Trenton Company had its fight in 1894) for $45,000. This will enable them to extend the line into the city farther than the present terminus, by affording an outlet from the bridge.

The Trenton & New Brunswick Railroad was incorporated last fall under the steam railroad act, and has begun work on the twenty-three-mile section to Milltown, where connection will be made for New Brunswick via the Middlesex & Somerset Traction Company's line. The road runs through a level section of country, and there will be no curves for the greater part of the distance.

The Delaware Valley Traction Company was incorporated last fall with W. F. Sadler, Jr., as secretary and treasurer, and rights of way are being secured for lines to Pennington, to Lambertville, and to Hamilton Square and Newtown, N. J.

The Philadelphia, Bristol & Trenton Street Railway Company has a line in operation from the termination of the Union Traction Company's lines at Frankford, Philadelphia, to Bristol, with the exception of a mile break at Croydon, which has been figuring in the courts since 1896, and for which several charters have been taken out. It is the announced intention of the people interested



TRENTON'S ELECTRIC RAILWAY CONNECTIONS

to extend the line to Morrisville, opposite Trenton, as soon as some satisfactory arrangement is reached regarding the break at Croydon. The Morrisville Traction Company, an ally of the Bristol line, has a piece of track laid on Green Street, in Morrisville, to hold the franchise, and also to secure rights in a street which the Pennsylvania Railroad Company is closing in order to avoid a bridge where the main line tracks are being shifted. Neither side has made a move since the track was laid last fall.

It is the intention of the Johnson syndicate or Lehigh Valley Traction interest to extend the Yardley, Morrisville & Trenton road to Newtown (Pa.) during the coming summer. Rights of way have been secured and the line will be built. The same interests are securing rights of way for a line up the river from Yardley to Newhope, and across the bridge to Lambertville, to which point the Delaware Valley Traction Company proposes building.

The New Jersey & Pennsylvania Traction Company also represents the Johnson interests, and proposes building a local road to cover all parts of Trenton with 3-cent fares and a minimum wage scale of 20 cents per hour. This is a similar plan to that offered to Cleveland by John B. Hoefgen, except that there are many streets in Trenton upon which cars could be operated without directly conflicting with existing lines. The center of the city would be the most difficult section to cover thoroughly with a new road. The Camden & Trenton Railway has also covered the city by maps filed, and several streets are already secured.

The Trenton, Philadelphia & Lehigh Valley Railroad Company planned a line straight across Pennsylvania, from Trenton to

Willow Grove, and this was also under the Lehigh Valley Traction management. It is said that when the Philadelphia & Lehigh Valley Traction line, now nearly completed between Allentown and Philadelphia, is in operation, the original plan regarding the line from Trenton to Willow Grove may be carried out.

The Doylestown & Easton Street Railway Company is building a line from Doylestown to Easton and has a part of it completed. It also has an extension planned from Plumstead to Point Pleasant, on the Delaware River.

The Newhope Street Railway Company has had a series of setbacks dating from 1899, when it attempted to secure rights of way from Doylestown to Newhope, under the name of the Doylestown Railway Company, but it is announced that all obstacles have been surmounted and that the work will begin at an early day.

The Newtown Street Railway controls the road of the same name and also the Newtown, Langhorne & Bristol line, operating cars from Bristol to Doylestown, twenty-seven miles, without change. This road was begun in 1896, and has been completed since 1899.

The Philadelphia, Somerton & Langhorne Street Railway has been securing rights of way from Somerton, Philadelphia, through Langhorne to Morrisville, where connection would be made with the Yardley, Morrisville & Trenton line from Trenton. Langhorne borough has granted it a franchise, and application has been made to Morrisville borough.

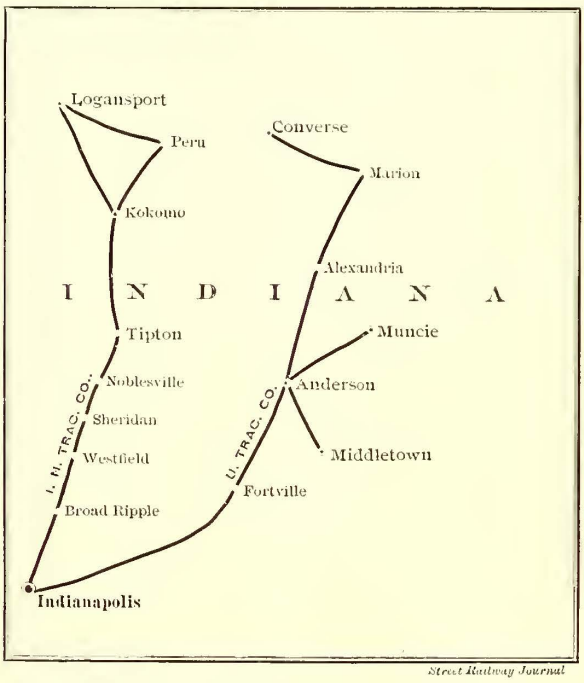
The Bucks County Railway extends from Doylestown to Willow Grove, twelve miles, and there connects with the Union Traction lines for Philadelphia. This is also under the control of the Lehigh Valley Traction.

Aside from roads which are immediately contemplated the Burlington County Traction Company expects to build a line from Moorestown to Mount Holly, and from Mount Holly to Burlington, but it is not known whether any work will be done this year or not. It has secured control of the Mount Holly Street Railway, which is operated by horse-power.

The extension of the Trenton, Lawrenceville & Princeton Railroad to Bound Brook is conceded to be one of the events of the near future, although no active steps have as yet been taken.

Interurban Railway Project

Another interurban system of magnitude has been undertaken by the Indianapolis Northern Traction Company, which filed articles of incorporation on May 14, with a capital stock of $3,500,000. The directors named in the articles are Charles A. Baldwin, Henry Moore, William H. Bloss, E. C. Carpenter, A. S. Richey, A. W. Brady and Charles Berry, all of whom are also connected in some capacity with the Union Traction Company.



MAP OF INDIANA INTERURBAN LINES

The new organization is a culmination of the Central Traction Company's interests, which have been taken over by the Union Traction Company, consisting of work done and rights and franchises secured through several counties and cities north of Indianapolis.

The accompanying map shows the combined Union Traction and Northern Indiana Traction Companies' system as it will be in the fall.

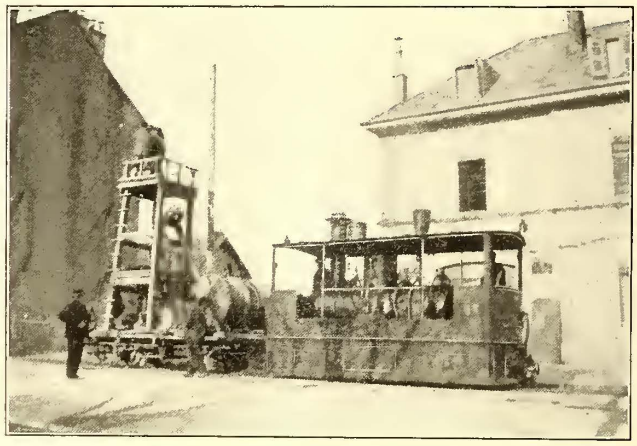
The articles of incorporation declare the object of the new organization to be for the purpose of building an electric line connecting Indianapolis with Logansport and the intervening points shown in the map. The whole system when completed will be acquired and operated by the Union Traction Company. The mileage is estimated at 145, which, when completed, will give the combined companies 300 miles of interurban lines.

The whole amount of securities for the new road has been underwritten by a Philadelphia banking syndicate, and was arranged by George F. McCulloch during his visit East last week.

The Union Traction Company already occupies a number of places in the system, and the work of construction will be pushed vigorously. The Kokomo-Logansport gap will be first constructed, then the Peru and Tipton divisions. The new company furnished a channel for the absorption of the Central Traction Company and other struggling interests. Mr. McCulloch said: "The people now feel that the system is not only assured, but that it will be among the best and most extensive in the country."

Stringing Trolley Wire by Steam

The accompanying engraving shows the method of erecting the overhead wire used by the Geneva Tramway Company, of Geneva, Switzerland, of which Stephen D. Field, formerly of Stockbridge, Mass., is general manager. The line was formerly operated in part by steam dummies, and these are now being replaced by the electric car. One of the old dummies has been kept in service, however, as the engraving shows, to help install the equipment necessary for its rival. No. 5 figure 8 wire is used, made by the Roeblings.



STRINGING TROLLEY WIRE BY STEAM

The construction truck consists of a platform car surmounted by the usual tower and carrying two large reels of wire. After leaving the reel, the wire passes around a direction sheave and is paid out as the car is drawn over the route. At intervals the reels are stopped, while the locomotive backs slowly to haul the wire taut, after which it is attached in position to the hangers. The view shows the completion of 140 km. (89 miles) of overhead line strung in this way.

Manual of Statistics

The Manual of Statistics, Stock Exchange Hand-Book, 1902 edition, marks the twenty-fourth annual issue. The publication is now broader in scope and more thorough in treatment of the subjects that come within its range than ever before. Its enlargement this year by the addition of one hundred pages was made necessary in order to fully and satisfactorily meet the requirements of the particular field that it occupies, and the present volume numbers 912 pages. It is not too bulky, however, for easy handling, and the arrangement of its contents makes it particularly convenient for ready reference. More space is devoted to street railways than formerly, and attention is called to the fact that many concerns are adding to their original transportation business that of furnishing light and power to the respective localities served by them. The volume is well arranged, and has voluminous indexes that add materially to its convenience and usefulness. The Manual of Statistics Company, 220 Broadway, New York, are the publishers.

Restrictions on the Controller Handle

BY J. R. CRAVATH

In the last ten years many plans have been proposed for restricting or automatically regulating the rate at which current is turned on in starting an electric car or train. There are many conflicting opinions as to the desirability of such devices in general, and the merits of the several forms in particular. Outside of the claims of promoters or inventors of apparatus of this kind, but little technical discussion has taken place as to the real merits and drawbacks incident to such appliances. Ten years ago there was a general feeling among those responsible for the electric equipment of street railways that there was some need of a check upon the rate at which a motorman could turn on current in starting a car. The injurious effects of such rapid turning on of current were evident on the equipments used in those days, which were often too light for the service, and a great deal of effort was expended in trying to get the motormen to make a practice of turning on current gradually. However, as the tendency of motormen is to turn on current rapidly, especially when they are repeating this operation many hundreds of times a day, this educational movement proved of little value, particularly on the larger roads, and the same may be said of such efforts at the present time. In order to keep down the excessive repairs to equipments of former days larger and larger motors were purchased, until a size was reached which would bear the abuse a car would invariably receive in practice. Perhaps electric railway men in the earlier days did not appreciate as fully as they now do the value of rapid acceleration in making fast schedule time; but, at any rate, the acceleration was there, and the fast schedules were made, whether the cause and effect of the fast schedules were realized or not. There still remained, however, even after motor equipments were increased in size, a strong desire on the part of many superintendents and electricians to limit in some way the use of excessive current in starting a car. On smaller roads the desirability of something of this kind was felt more than on the larger systems, because on the small road usually the necessity for the fast schedule with frequent stops was not so great, and then, too, the power house felt more keenly the great fluctuation brought about by the use of a large volume of current in accelerating a car.

Probably the first attempt to limit the rate of turning on current, other than by instruction of motormen, was the automatic circuit breaker, closely adjusted, which would open every time a man used more current than the breaker was set for. A number of years later came a recording device, which would simply record excessive rushes of current without the annoyance of opening the circuit and without the chance for tampering offered by the circuit breaker. About this time also the recording wattmeter was adopted for use on cars, and this was supposed to have a restraining moral influence on the rate at which motormen would turn on current, though later developments proved otherwise. Still later a number of devices, which limited the rate at which the controller handle could be advanced from one point to another, or which took the rate of turning on current entirely out of the motorman's hands, were introduced. Some of these devices have depended upon mechanical means of regulating the rate of advancement from one point to another, such as dash pots and pendulums, while others have been dependent upon the current flowing through the motors. In the latter, advancement of the controller from a lower to a higher point could only take place by the current through the motors or through one armature falling below a certain predetermined amount, for which the device was set.

In connection with all these schemes two questions arise:

First, what are their advantages and disadvantages from a technical or engineering standpoint?

Second, are they sufficiently simple in their practical application to make them worth while?

It must be admitted at the outset that a rapid acceleration in city service is absolutely essential, and if the motors and power house are not designed to provide for this they must be changed. On suburban and interurban lines, with motors geared for high speed, it is certainly desirable to limit the heavy accelerating current that will flow if attempt is made to start motors quickly when geared for high speed and consequent low torque per ampere. The gain from rapid acceleration on such lines is very small. The question is whether the rate of acceleration, or at least the rate of turning on current should be left in the motorman's hands or as far as possible regulated automatically. A few years ago there was considerable speculation in the minds of some street railway men as to the waste of current which took place in the starting of a car, and not a few confused the idea of excessive current with that of waste of energy; it being sometimes erroneously assumed because a large volume of current was taken in starting a car that there was more waste of energy than if less maximum current had been taken. The mechanical energy required to start a car is, of course, the same whether it is started quickly or slowly. In the former case the accelerating power is high for a short time, and in the latter case has a lower value, but lasts for a correspondingly longer time. This, however, is somewhat aside from the real point under discussion. The question is whether the best rate of acceleration for different cases can be surely obtained by leaving the controller handle entirely free, to be turned according to the motorman's ideas, or whether devices could be used with advantage which take the rate of turning on current out of his hands.

It is frequently the case, especially with a slippery track, that a motorman will not exercise the judgment displayed by a locomotive engineer in starting. The motorman is prone to throw on current at such rate that the wheels spin, with the result that instead of bringing the car up to speed rapidly as he desires, considerably longer time is required, because the tractive effects of wheels spinning on the rails is only about one-third of that just before the point of sliding was reached. This, of course, is a practice which an automatic-restricting device should prevent, except under very unusual track conditions. It is also probably true that better practical results could be obtained if motormen were restricted from advancing the controller from series to parallel as quickly as they frequently do. Motors, when in series, give double the torque per ampere of current drawn from the line that they do when operating in parallel, and the most economical acceleration requires that the controller be kept on series points long enough to secure this advantage. Too rapid throwing in of shunts around the fields also tends to decrease the efficiency of acceleration and overheat the armatures. The line loss between the power house and the car, which varies according to the square of the current, will naturally be less with lower rates of acceleration, requiring lower maximum current. This is considering the possible advantages of such appliances from the power-saving standpoint alone. There is besides this the important consideration of keeping down motor repairs, caused by habitual use of excessive current where the motor equipments are not of sufficient size to stand such a strain. This is a point of much practical importance on a large number of roads.

Just how much saving in power or repairs can be effected by the use of such appliances, under given conditions, is a matter upon which more evidence is needed before general conclusions can be reached. There has been some tendency to confuse power saving by the use of devices limiting the rate of turning on current with general power saving by motormen. Motormen can waste electrical energy in two ways, one of which has just been outlined; the other way is by failing to drift as much as possible with the current off, accompanied by the unnecessary use of the brakes. That this latter source of loss is a considerable per cent of the 20 per cent to 30 per cent of energy wasted by motormen in ordinary operation seems to have been shown in the case of roads which have experimented with recording wattmeters on a number of cars. That there is a great waste of energy at the present time in the ordinary operation of cars has been demonstrated too thoroughly to be questioned, but just how these losses may be divided is something which has yet to be determined. Where wattmeters have been put on cars and motormen have been left free to turn on current at whatever rate they saw fit, it has been found in some cases that the motormen who were most economical in watts per car mile were the ones who turned in the hottest motors at the end of the run. They had been working on the plan of accelerating as rapidly as possible and drifting as much as possible; which, as is now generally known among electric railway engineers, is the most economical way to operate a given schedule from the standpoint of energy consumed per car mile.

Aside from the considerations before discussed there is a very manifest advantage in any limiting apparatus of this nature from a passenger's standpoint. The jerking of cars in starting by motormen passing two or three controller points at a jump is far too common. On some roads a passenger standing in the aisle must be skilled in the ways of the road if he hopes to maintain his balance, and the stranger in town has a hard time indeed. Now this does not improve either the temper of the passengers or the total acceleration of the car, and may even be a fruitful source for damage suits. What is needed in city service is smooth and rapid acceleration from the first to the last point of the controller. Experience would seem to have demonstrated that it is impossible to attain this service without the use of an automatic device. One characteristic is common to all such devices, namely, that the rate of acceleration on a clean track can be much higher than on a slippery track. If the device is set for a rate of acceleration which will prevent the slipping of wheels on a slippery track, it will also

prevent the rapid acceleration which might be desirable in making up lost time when the track is dry or clean. On the other hand, it is true that street railway schedule time is usually the same for all conditions of weather, and that the rate of acceleration and breaking which can be depended upon with a slippery track is the one which limits the schedule time which can be made, and hence the need of more rapid acceleration on a dry track is not felt because the schedule time is the same for dry days as for wet.

It is out of the province of this article to discuss the individual merits of the several devices which have been proposed, but this discussion of the principles involved may serve to explain some points in connection with the purposes and possibilities of such appliances, which have not, heretofore, been clearly enunciated, and about which there seems to have been considerable misconception on the part of those who have not studied the subject.

A Comprehensive Rapid Transit Plan

The Rapid Transit Commissioners have authorized Chief Engineer William Barclay Parsons to prepare a comprehensive plan for furnishing rapid transit to all parts of Greater New York. The instructions allow the engineer considerable latitude, and merely outline the general desires of the Commissioners. The subject has been very carefully investigated by the board, and, while it is recognized that it will be some time before the plans can be put into execution, the Commissioners have arrived at the conclusion that it is time to take steps for the development of a scheme that will be more than temporary in its application. Consequently, they have instructed their engineer to prepare a plan that will provide for future extensions and afford the city a permanent system of rapid transit that will embrace the five boroughs of Greater New York. It is estimated that the plan will involve an expenditure of at least $50,000,000. At the meeting of the Rapid Transit Commissioners, at which this decision was reached, Mr. Orr, the chairman, formulated the following letter of instruction, which was afterwards approved by the board and communicated to Mr. Parsons:

When the plan now under construction was adopted the board was careful to announce that it formed only a part of a more comprehensive system which the board intended to lay out as soon as the financial condition of the city should permit. In the hope that such financial ability is not far distant, the board instructed you at its meeting held on the 1st inst., to submit plans for an East Side line connecting with the present rapid transit route at Forty-Second Street and Park Avenue. This instruction did not imply a determination of the board as to what should be the next rapid transit route adopted, but only that the necessities of the upper East Side would have to be studied and considered, as would also the further claims of Brooklyn and the claims of other boroughs.

The board is almost ready to advertise the contract for the Brooklyn-Manhattan extension already adopted. It has, at the request of the Mayor, begun the consideration of a comprehensive terminal system intended to include the present Brooklyn Bridge and the bridges Nos. 2 and 3, now under construction. It has received from the Pennsylvania Railroad Company, and is now considering, an application for the grant of a franchise for a tunnel railroad under the Hudson River, across the borough of Manhattan, under the East River and connecting in the borough of Queens with the Long Island Railroad system.

Under the amendment to section 32 of the rapid transit act and without further legislation, as I am advised, it will also be possible with a co-operation of the city authorities upon which, I believe, we may count, for the board upon the application of the New York Central and Hudson River Railroad Company, to authorize an enlargement of the terminal facilities of that company so as to permit it to make the peremptorily needed change of motive power in the Park Avenue tunnel, I earnestly hope that such an application will presently be before the board.

It is, therefore, clear that the public now has a right to expect from this board the preparation of a general and far-reaching system of rapid transit covering the whole city of New York in all its five boroughs.

This plan could not, of course, be carried out at once, or, perhaps, completely carried out for many years. But if such a plan be now wisely prepared and the streets of New York be dedicated to tunnel railroad purposes with a proper regard to the long, and, no doubt, splendid future of the city, two things may reasonably be expected. First, that rapid-transit construction will proceed upon the lines so laid down as rapidly as the means of the city and the amount of private capital ready for rapid transit investment will permit. And, second, that relatively unimportant franchises will not be granted in such a way or special routes be so devised as to prevent or obstruct a permanent and sufficient programme.

Chairman Orr also sent the following letter to President Newman, of the New York Central, inviting an application from that road for permission to increase its terminal facilities, with a view to changing its motive power in the Park Avenue tunnel:

I am requested to ask your attention to the amended form of section 32 of the rapid transit act and to its relation to the enlargement of the terminal system of your railroad in New York, more especially with respect to the substitution of some new motive power in place of steam for your trains operated in the Park Avenue tunnel. The board is advised that, without any further legislation, this section of the rapid transit act as amended is sufficient, with the co-operation of the local authorities under laws now in force, to enable the board, if your company shall see fit to make application, to prepare a sufficient and proper franchise for such extension of your terminal facilities. If your company shall come to consider this suggestion I am authorized to say that this board will appoint a committee to take up the matter with your representatives.

This action on the part of the Rapid Transit Commission is announced simultaneously with an offer from Mr. August Belmont, president of the Rapid Transit Construction Company, which is building the present tunnel, to undertake the execution of the board's plans and furnish all the money that will be necessary for the construction of the new routes and the operation of the system until such time as the city is in a position to assume the management and operation. Mr. Belmont's letter follows:

It is apparent from the most recent reports of the Comptroller which have come to the notice of the Rapid Transit Subway Construction Company that on account of the approximation of the city debt limit to the constitutional limit the Rapid Transit Railroad Commission will not be able for a long time to do any more than authorize the Brooklyn extension, even if it can do that at an early day.

It appears to the Rapid Transit Subway Construction Company that the development of rapid transit in New York City must necessarily suffer seriously and meet at the outset a check to its growth which public sentiment would view with much disfavor.

The operating company, which will shortly be organized, representing the same interests as the Subway Construction Company, will be prepared to construct extensions and connections with its own capital and credit, provided the means and methods can be arrived at for doing so. I suggest as a plan approved by our executive committee that such extensions and connections can be built on bonds of such operating company, which necessarily will have to bear a higher rate of interest than the city bonds, convertible into city bonds at the option of your commission, the construction being in all details conducted precisely in the same manner as the present work is being done and becoming a part of the system as a unit.

If this suggestion meets with your approval, I shall be glad to appear at any time which may be agreeable to you before your board to discuss it more in detail. As the rapid transit act will probably have to be amended in some particulars in order to enable such plan to be carried out, and as the present session of the Legislature will probably be a short one, I would suggest that the matter be taken up by your counsel, in connection with ours, to determine in what respects such amendments should be made, and to frame and introduce a bill for the Legislature, always assuming that the general suggestion meets with the approval of your board.

Of course it will be some time before definite plans can be reported by the engineer, as the work is of such a comprehensive character as to require very careful and extended investigation, probably involving the solution of many engineering problems. The details of the scheme, especially those pertaining to terminal facilities, will necessitate a careful study of the conditions affecting the several boroughs. However, the fact that the commission has recognized the necessity of formulating a comprehensive plan of this character shows that it fully appreciates the importance and pressing demand for improved rapid transit facilities.

Warned against Third Rail

Edward F. Croker, chief of the New York Fire Department, has sent a circular to all of the engine houses in the boroughs of Manhattan and the Bronx warning the firemen of the dangers of the third rail on the elevated railroads when fires occur near the tracks, as follows:

"The power and character of the current used are not regarded as particularly dangerous, and, in fact, if the track ties and plank walk are dry, a man standing upon them may touch the third rail without receiving any shock. If the track ties and plank walk are wet, a man standing on them and touching the third rail will receive a shock, but it is believed, under ordinary circumstances, not a dangerous one. It is believed that the only way in which a dangerous shock might be obtained from the current which is used is by actually falling across the third rail, at the same time touching the metal work of the structure."

The circular directs that the power house at Seventy-fourth Street and the East River be notified when it becomes necessary to cut off the power because of fire.

The trainmen on the Manhattan lines operated by electricity have instructions from the company not to allow passengers to leave the cars when any accident happens which requires the train to stop between stations. Formerly, when steam locomotives were used and there was any temporary delay, the passengers frequently left the trains and walked on the footboard along the side of the track to the station. The introduction of electricity has led the company to order a strict enforcement of the rule prohibiting passengers leaving the trains excepting at stations.

CORRESPONDENCE

Wanted—A Car

New York, May 10, 1902.

EDITORS STREET RAILWAY JOURNAL:

The debatable ground between spring and early summer is now upon us, and our friend the superintendent is kept busy guessing whether it will be safe to run open cars. Large systems with a complete double equipment find it hard enough to forecast the intentions of the clerk of the weather and provide for the public, but small roads are in a predicament even less agreeable. Why does not some ingenious friend of humanity design a combination car which can be transmuted to suit the vagaries of the American climate? We are all well aware that there are several types of combination cars on the market, but for one reason or another, in spite of some excellent qualities, they do not seem to catch on. The demand is genuine enough and large enough to stimulate invention, but somehow the results are not such as to meet the demand. It is somewhat difficult to analyze the reasons for this condition of things, but that it exists is painfully evident. Perhaps the most frequent trouble is lack of seating capacity. The ordinary winter car with lengthwise seats is very easily filled and emptied, and has a very large additional capacity for standing room, but a summer car, to encourage pleasure riding, must have cross seats and needs little standing room on the platforms. On interurban lines there are many winter and convertible cars in use having cross seats and a central aisle like ordinary railway cars. But so far as I have observed, the seats and aisles are uncomfortably narrow, owing to the small width of the car, and the plan seems to be only moderately successful. As to summer cars there is too considerable loss of seating capacity as compared with the ordinary type.

It is unpleasantly evident then that the designer of a convertible car has a hard row to hoe. If it were practicable to shift a car about so as to have lengthwise seats as a winter car and cross seats as a summer car things would go pretty smoothly, but the work of changing over would be no joke, and the increase in movable parts would probably introduce ten or a dozen new and dreadful varieties of rattle, added to those which may generally be found. It seems to be fairly easy to make a car that will open up sufficiently for summer work, but the seating question is serious. If one were dealing with a climate that is on really debatable ground all the year round, like that of California, the remedy there applied, of a composite closed and open car, would be highly successful, but the major part of the country has unqualified summer and winter seasons that admit of no such compromise. It is probable that as time goes on more and more interurban roads will plan their tracks for the use of slightly wider cars than at present, and also make up in the length of car for the seating capacity lost in the usual railway construction, so that the difficult problem can thus be solved, but for city use such cars do not admit of easy access as compared with the usual standard types. The ordinary open car, in spite of the benign efforts of the "end seat hog" is very quickly filled and emptied, and hence is wonderfully convenient for dealing with heavy traffic. However, city roads usually have a complete double equipment, so that their troubles are relatively few.

And, speaking of car construction, why is it that the double-decked car, which is so great a favorite abroad, has never found a pleasant greeting on this side of the water? A few such cars have been built in this country, but they did not seem to fill any long-felt want and attained no popularity. They were, of course, rather heavy for the time at which they were introduced, but no heavier than plenty of cars now in successful use. Probably the comparative inaccessibility of the top seats was the strongest objection, but the seating capacity for the weight of the car was amply large. American hurry, however, does not take kindly to unnecessary steps, and the climbing settled the matter. In fact, even abroad the American type of car is steadily making headway. The world wags along, and even the most conservative European practice eventually is shaken up by the coming of the Yankee.

And speaking of cars, the polynomial inventor of fenders is still pegging away at his job without as yet getting a firm hold on current practice. Every little while a new device is tested, and then as a rule one hears no more of it, although out of the struggle have emerged several that deserve consideration. Most fenders ride too high to be of any great service, except in quieting importunate boards of aldermen, and those which can be brought close to the track are too often undesirably complicated. I am far from despising fenders, and I believe that there are some good ones, but there is not yet any one so successful, or any general construction so successful as to dominate present practice. A hue and cry is now and then raised for fenders, as for vestibules, but without any marked effect. To be of real use a fender must be capable of depression close enough to the track to scoop up, instead of riding over a person who has fallen, and yielding enough not to inflict serious injury while still protecting against a blow from the car front. These are not easy requirements to meet, and many have failed where few have succeeded. There can be no doubt that a fender really meeting these requirements would work its way into certain popularity. At all events it is a thing worth working for, though in the last resort complete safety, it must be remembered, is to be found in giving a fast-running car a wide berth; a good clearance is better than the softest fender.

SUPERINTENDENT.

Destination Signs on Cars

PHILADELPHIA, PA., May 16, 1902.

EDITORS STREET RAILWAY JOURNAL:

I saw some time ago a discussion in your columns on the best method of designating the routes of street cars by destination signs, but your correspondent found fault with most of the present methods without suggesting any improvement. I believe that some of the methods in use are most confusing, especially to strangers in the city, and I have been waiting to see whether any further communications would appear on the subject. As none has yet been published I would like to call your attention and that of your readers to the numbered route method, which is the best with which I am acquainted. In this method every route is given a number and this number is painted in black on a white sign carried on the dash. There is no difficulty in making these so distinct that they can be seen a block or more away.

This need not interfere in any way with the usual street signs if desired, but will be the method by which the cars will usually be recognized. The resident will, of course, soon be able to identify the cars by their numbers, while the stranger can easily be instructed to take route "10" or "17" to reach his desired destination. Numbers are more desirable than letters for this purpose, because they can be more easily distinguished and the routes on most roads would number more than twenty-six. There may be a number of cities using this system, but the only one that I now recall is Hamburg, Germany.

A. P. JONES.

Management of Men

VICKSBURG RAILROAD, POWER & MANUFACTURING COMPANY

VICKSBURG, MISS., MAY 10, 1902.

EDITORS STREET RAILWAY JOURNAL:

I am very much interested in your article in the current issue of the STREET RAILWAY JOURNAL on the "Management of Men." I have read it with a great deal of care, and find one especially good point in it, namely, the system of promoting men, not according to seniority, but according to their record while in the employ of the company. I am going to take this matter up immediately, and think it very likely that I will adopt it. I notice, though, in your enumeration of the different systems of managements, that you failed to mention one which we are using here, and as it is working so well with us, I thought it possible that it might be of interest to the other readers of your paper.

We have a small road here, and employ only about forty conductors and motormen, but I believe that the same system will work as well, if not better, with a large force of conductors and motormen. I based my ideas in formulating this system upon the Brown system of demerits, which is so largely in use, and also upon the different bonus systems which are used by a good many roads in the country. We offer a premium of $5 per month to each motorman and conductor whose service to the company during the month is perfect. We divide this $5 into 100 points, of 5 cents each. We have a list of rules, and opposite each rule is the number of demerits which the breaking of this rule carries with it, and one demerit is equal to one point, or 5 cents. These rules are posted in conspicuous places and are also copied in the rule books. The superintendents and the supervisor are provided with a small package of report slips of the proper size, so as to be carried in the pocket easily, and whenever they see a man breaking a rule, they don't say anything to him, but immediately fill out one of these blank slips and turn it into the office. The office then has a copy of this report made on a larger sheet of paper, and it is mailed to the conductor or motorman whom the report is against. He is given two days in which to make a written explanation on the back of the slip, regarding the report. This is then filed, and at my convenience, before pay day, I take these reports with the explanations and go over them very carefully, and where I think the explanation is satisfactory, or when there are extenuating circumstances, the report is removed;

but if the report is not satisfactory, it is put down on the record against the employee, and on pay day the number of demerits which he has received in the last thirty days is multiplied by 5 cents, and this amount is deducted from the $5 premium which he would have gotten had he not received any demerits.

We find so far that this has worked splendidly, and that it is a matter of no little pride to the men when they get the full $5 at the end of the month. We don't give an extra premium for especially meritorious acts, as we believe that if a man does not get any reports during the month, his general behavior is meritorious, and, therefore, he receives the $5. This makes it much simpler, as it is very hard to judge as to whether these special acts are always deserving of extra merits. Of course, I don't mean to say that we do not recognize cases where the employees use especially good judgment while on duty. We always make it a rule to thank our men personally in such cases, but we do not give any extra points or money for these especially meritorious acts.

Herewith are samples of the blanks we use in this system, which may be of interest to your readers:

VICKSBURG RAILROAD, POWER & MFG. CO. REPORT.

Name .....
Date ..... Time ..... Car No.....
Line ..... Place .....
Report .....

NOTIFICATION BLANK.
VICKSBURG RAILROAD, POWER & MFG. CO.

Vicksburg, Miss., ...190....

Mr. .....

DEAR SIR:—I wish to advise you that you have been reported as follows:

Date .....190.... Time .....M.
Place .....
Car No. ..... Line .....
Report .....

You will please make a written explanation of the above not later than ..... I hope your explanation will be such that we can remove the charge, but in case it is not, you will receive.....demerits.

.....
GENERAL MANAGER.

Make written report on back of this sheet.

EXPLANATION BLANK.

MR. JAMES Z. GEORGE,
GENERAL MANAGER.

DEAR SIR:

Regarding report, I beg to say.....
(Signed,) .....
(Motorman or Conductor) .....

The report forms are slips 3½ ins. long and 4½ ins. wide. The notification form is about the same size as an ordinary sheet of note paper, printed on both sides—one being for the notification, and the other for the explanation. The sheet is 8½ ins. long and 5½ ins. wide.

James Z. George.

Wheel Sections

Editors Street Railway Journal:

Referring to the articles regarding wheel sections in the issue of April 26, it would seem to me that several considerations as to proper construction of wheel section have not been clearly presented.

The most important point refers to the quantity of metal above or outside the point where the flange comes above the rail. As stated by you this added metal is intended to support the flange. There are, however, objections to this which are of the greatest importance to good service.

In the first place, as is shown by one of your correspondents, wheels wear down considerably in diameter, in some cases 1½ ins. or ¾ in. in radius. It is therefore apparent that all added metal above and back of the flange, as originally made, must wear off by friction against the guard rail to the same extent that the wheels diminish in diameter. It is quite unnecessary to dwell on the serious objections to this point, but the principal features can be enumerated as follows: Broken and bent axles, loose wheels, worn guard rails and switches, and chipped and broken flanges.

It seems to me that the dimensions between the inside of flanges on axles should be reduced to a strict minimum, so as to leave only the play absolutely necessary, but beyond that point absolutely no metal should be added if difficulties are to be avoided.

The next is the form of flange; the wear on flanges in grooved tracks being about the same on both sides, the form should be practically the same as, for instance, the M. C. B.; but as electric motor wheels wear down so considerably, metal should be added above the flange without increasing its thickness so as to avoid too thin a section at the root of the flange when wheels have become considerably worn. The only section of wheel as proposed in your article, excepting the M. C. B., which seems above criticism is No. 72 which combines the elements here referred to.

In regard to cost of car wheels per million miles it is not clearly stated whether the scrap value has been deducted. This is an important point, and as the results on the lines mentioned differ so greatly, it would seem to be important to have more accurate information, including all expenses of replacements. J. H. F.

Merxem-lez-Anvers, April 29, 1902.

International Tramways Exhibition

Arrangements have been completed for the second International Tramways and Light Railways Exhibition, at Royal Agricultural Hall, London, beginning Monday, June 30, and closing on Saturday, July 12. This exhibition promises to be comprehensive and instructive, affording a practical illustration of the development of the industry during the last two years. The fact that it is to be held simultaneously with the International Tramway Congress, and that a number of minor organizations, representing the transportation systems of Great Britain controlled by municipalities and corporations, will meet at the same time, will lend particular interest to the occasion and will undoubtedly stimulate the efforts made by exhibitors, especially those who are prepared to supply apparatus to the Continental tramway companies. It is said that nearly all the available space has been taken, 150 concerns having made application.

The programme for the International Tramways and Light Railways Congress has already been published in the Street Railway Journal. The subjects selected for discussion at the several meetings include many problems of vital importance to all who are interested in the development of the industry. The chairman of the congress committee of the Tramways and Light Railways Association, R. H. Scotter, has been collecting information for some time on the subject pertaining to the management of the railway properties in England and on the Continent, and he will incorporate this data in a report on the subject of legislation in all countries relative to tramways and light railways. The data which he is collecting covers every feature of organization, management and operation, and it will undoubtedly prove of great value to the members of the association.

The committee announces that its arrangements for the entertainment of members have been completed. The formal opening of the Congress will take place on Monday afternoon, June 30, at the Berners Hall, Agricultural Hall, Islington. The opening of the Tramway Exhibition will follow immediately.

In the evening a reunion or conversazione will be held, when those invited will be the joint guests of the Union Internationale Permanente de Tramways and of the association.

On July 1, 2 and 3 congress meetings will be held at the Berners Hall in the forenoon, and excursions will be made in the afternoon. On Friday the Congress will sit until it completes its labors, and in the evening a banquet will be given by the association at De Keyser's Hotel. On July 5, and possibly on the 6th, it is hoped that excursions may be arranged.

The headquarters of the Congress will be at the Agricultural Hall. There will be a general committee room during the Congress at De Keyser's Hotel.

Messrs. Dean and Dawson, Charing Cross, S. W., have been appointed official tourists and hotel agents.

Members of the Association are reminded that only members of the Union Internationale Permanente de Tramways will be admitted to the ordinary meetings.

The Congress committee, to whom the Council has delegated full powers, consist of R. H. Scotter, Everard R. Calthrop, J. W. Courtenay, A. M. Willcox, with the following ex-officio members: Sir C. Rivers Wilson, L. A. Atherley-Jones, C. R. Bellamy, Lieutenant-Colonel R. E. B. Crompton, William M. Murphy, Stephen Sellon and Ernest Benedict.

Newspaper despatches from London state that it is rumored that Messrs. Morgan and Yerkes have made arrangements for placing on the Thames a service of American-built boats, which will be operated for the benefit of the public in place of the old penny steamers, which have until now given a most inadequate service. It is doubtful whether the project is of sufficient dimensions to interest either of these well-known financiers, however.

A Novel Combination of Polyphase Motors for Traction Purposes*

BY ERNEST DANIELSON

During the last few years there has been a great deal of discussion as to the possibility of using alternating current motors economically for traction purposes. The result so far obtained seems to be that while these motors may prove successful not only technically but also commercially in special cases, as a rule they are inferior to the direct-current series motors for general work. The reason for this is that the polyphase motors behave like shunt motors, that is, operate economically only at a certain speed, and that, accordingly, other speeds are obtained only with a sacrifice in economy. It is true also that the induction motors have other drawbacks, for instance, the wattless currents which necessarily belong to them, but it seems that the advantages which they possess in simplicity and of doing away with sub-stations using rotating machinery are important enough to compensate for the disadvantage of wattless currents. It has also been pointed out by Mr. Scott at the Buffalo convention when advocating the direct-current motors for electric railway service, that the invention of a speed changing device might alter the situation. The author here proposes to deal with an arrangement which makes it possible to obtain economically four different speeds by means of only two motors—an arrangement, which, it seems, will do away with some of the difficulties now experienced in applying the induction motors to railway work.

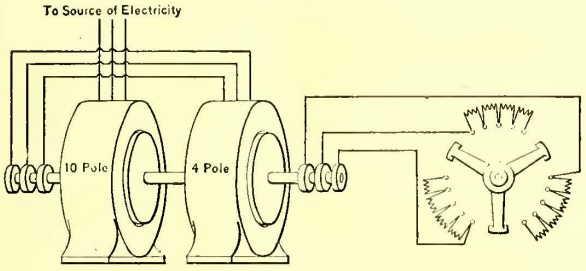


FIG. 1

As is well known the concatenated control of two induction motors consists in connecting the secondary circuit of one to the primary of the other, mechanical connection being arranged so as to make the moving parts of both motors always run at the same speed. In this way a combination is obtained giving a speed corresponding to half of the regular speed of each motor.

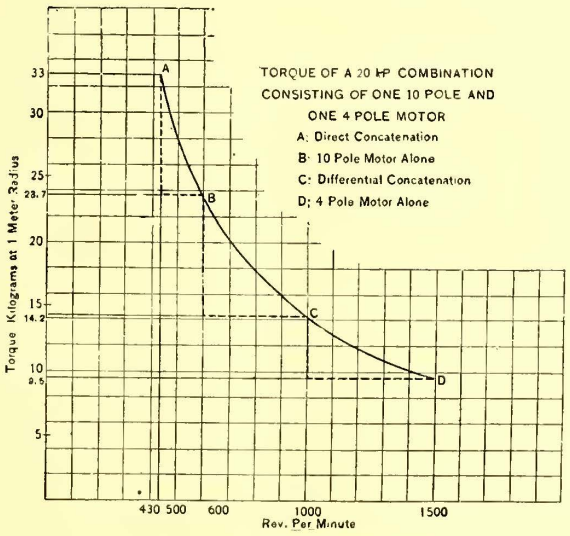


FIG. 2

The torque of each motor will be the same when used singly or in concatenated connection. This means that the output of the concatenated combination is only half of the output of the motors operating independently. If, instead of using two similar motors, two motors of different speeds (that is, with a different number of poles) are combined in concatenated connection, a speed is obtained which corresponds to a number of poles equal to the sum of both motors. Suppose a combination of a six-pole and a four-pole motor and that the frequency = fifty cycles per second, then three different speeds are possible, viz: the speed of the four-pole motor alone (the six-pole motor running idle) = 1500 r. p. m. (minus slip), the six-pole motor speed = 1000 r. p. m. and the combination speed = 600 r. p. m. If both motors are of the same horse-power, say, for instance, 50 hp, it is easy to see that the combination gives also 50 hp. By means of this arrangement we have accordingly got a motor capacity of 50 hp at three different speeds, 1500, 1000 and 600 r. p. m.

But it is possible to go still further. When connecting in concatenation we have the possibility of making the connection either so that the torque of both motors works in the same direction or by crossing the leads combining the secondary of the first motor with the primary of the second to get a resultant torque which is the difference between those of the two motors. This arrangement may be called a differential concatenated connection. In order to see the result of this, let us suppose two motors, one with ten poles and one with four poles, both of the same output, say 50 hp each, the rotors of which are mounted on the same shaft (Fig. 1). If now the source of electricity be connected to the stator of the four-pole motor, and the rotor winding of the same motor be connected to the rotor winding of the ten-pole motor in such a way that the magnetic field in both rotors will revolve in the same direction relatively to their cores, the torques of both motors will be opposite to each other. As both motors have the same output, then if the torque of the four-pole motor be called unity, that of the ten-pole motor will be 2.5; accordingly, the resulting torque in this case will be 2.5—1 = 1.5 and acting in the same direction as that of the ten-pole motor. As the system begins to move, the frequency in the circuit belonging to the rotors increases, whereas the frequency in the stator of the ten-pole motor decreases. Started in the regular way by inserting resistance in the last secondary and gradually cutting it out, the speed comes up until the frequency in the stator winding of the ten-pole motor approaches zero, which will happen when the speed is 1000 r. p. m. (the frequency, as before assumed = 50 cycles per second), that is to say we have obtained a motor running at 1000 revolutions and with a torque which is represented by 1.5; the torque of a 1500 revolution motor (four-pole) of 50 hp being = 1. Accordingly the horse-power of this arrangement is still fifty. By means of this combination of two motors we can thus obtain the same output under following conditions: 1 : 0. The four-pole motor alone—the ten-pole running idle—speed 1500 r. p. m. 2 : 0. Differential concatenation speed = 1000 r. p. m. 3 : 0. Ten-pole motor alone—four-pole motor running idle—speed = 600 r. p. m. 4 : 0. Regular or direct concatenation—speed = 428 r. p. m. These torques and speeds are graphically represented in Fig. 2, which gives the torque for any of the speeds with regular full load current on a 20-hp motor. No attention is however given to the lag, which, of course, is considerably greater in the concatenated connection—direct or differential—than with one motor alone.

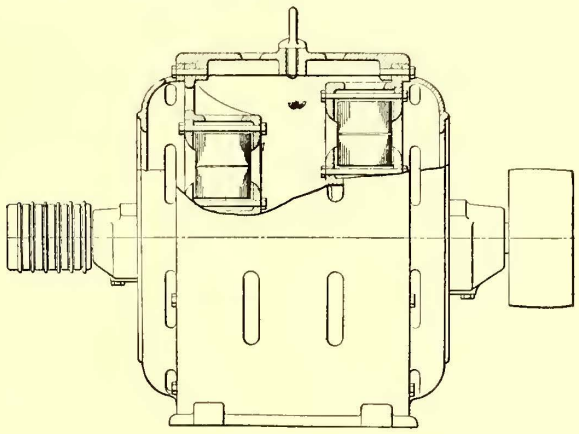


FIG. 3

Fig. 3 shows a small motor built on these principles and which is intended for running tool machinery in a workshop. It is designed with one side ten-pole (large diameter) and the other four-pole, and accordingly gives the same synchronous speeds 428, 600, 1000, 1500.

It goes without saying that if gearing of some kind be used, the motors need not have different numbers of poles; for instance, if both motors are identical and are geared to the same shaft, so that one gives a speed of 0.617 of what the other gives then the speeds which are possibly obtainable form a geometrical series, the ratio of which is 0.617; that is to say, it is possible to obtain four

* Read at the annual meeting of the American Institute of Electrical Engineers at New York, May 20, 1902.

different speeds each of which is 0.617 of the one which is nearest higher.

Before investigating how this method can be applied for railway motors there should be pointed out some features which are interesting in the differential concatenation. As was first noticed by Steinmetz a system of two equal motors in concatenated connection can operate at two different speeds, one of them being practically the same as if the motors were driven independently, that is to say, double the speed of the concatenated speed proper. With a system of two unequal motors the same phenomenon appears; a concatenated pair consisting of one six-pole and one four-pole motor can also run with six-pole speed if the six-pole motor is connected to the source of electricity and with four-pole speed if the four-pole motor is nearest the source. In all these cases there is no risk of obtaining these secondary speeds instead of the one which is desired, because the desired concatenated speed is always lower than the secondary speeds. Thus, when the desired speed is reached the motor cannot of itself get higher.

With the differential concatenation the matter is a little more complicated. When describing the differential method we have, for the sake of simplicity, assumed that the motor with the fewer number of poles was used as the primary motor, that is, connected to the generator circuit. In this case the secondary speed which is obtainable is the speed of the prime motor itself and in opposite direction to the differential concatenated speed proper. Consequently there is not even here when starting any possibility of getting the wrong speed instead of that desired. But suppose that the ten-pole motor had been the primary motor. Evidently the starting would take place in the same way as before, but when the speed of 600 revolutions is reached the motor would not get up any higher but would continue to run and develop torque as soon as the speed falls a little short of 600 r. p. m. That the differential speed of 1000 revolutions (minus slip) works just as well with this connection as with the other will be clear from the following:

Suppose that the connections are exactly as before described for differential concatenation only, with the difference that the generator is connected to the stator winding of the ten-pole motor and the rheostat to the stator of the four-pole motor. If now the rotating field in the ten-pole motor operates clockwise and by some external force the machine is speeded up to, say, 970 r. p. m. clockwise, what will happen? The magnetic field in the ten-pole rotor moves relatively to the iron core with a speed of 600—970 = —370 r. p. m., and its direction of rotation accordingly is counter clockwise in the iron. The relative speed of the magnetic field in the four-pole rotor then is $370\times10/4$, also counter clockwise. The absolute speed therein is clockwise and $=970-370\times10/4=45$ r. p. m. Evidently when this field revolves clockwise—in the same direction as the movement—the four-pole motor acts as a generator. The action is exactly the same as that of any induction motor with its primary element rotating, running at a higher speed than synchronism. Now the currents from this generator are used to speed up the ten-pole motor, when at the same time evidently the torque required for running the four-pole generator part of the system is subtracted from the ten-pole motor part. The case is analagous to this: Take a regular induction motor and connect not only its primary but also its secondary to the source of electricity. Then with proper connections we can obtain twice the regular synchronous speed of the motor.

That the ten-pole part of the motor system in this case acts as a motor and not as a generator can be proved in this way. When in an induction motor the speed of the rotor falls short of the synchronous speed, then the current induced in the secondary winding is nearly in phase with the electromotive force that produces it, that is to say, the rotor winding carries what might be called a generator current. If, then, the rotor increases its speed so as to exceed that of the revolving field of the primary then the electromotive force induced in the secondary part (rotor winding) would change its phase by 180 degs. in relation to the magnetic field; hence it is clear that the current in the secondary winding now has to be in opposition to the phase of the electromotive force; that is to say, in order to make an induction motor work as a motor above synchronism its secondary winding should not itself generate its current, but a current has to be let onto it against its own electromotive force. This is exactly what happens in one motor here as we have pointed out that the four-pole side acts as a generator and then, of course, the electromotive force from the ten-pole rotor acts as a counter electromotive force.

On account of this we find that also with this connection the motor will act as a motor with $10-4=6$ poles just the same, but that it will not by itself get up to the right speed, but has to be speeded up by some outside force.

Having now described the methods of the differential concatenation in combination with the direct one the next question is this: What advantage can be derived from this arrangement for railway work? Immediately it will be clear to a student of these matters that one advantage of an important nature is the possibility of using economically four different speeds instead of two. (As a matter of fact the method of getting three different speeds has been known for some time, but so far as the writer is aware it has not yet been used for traction purposes.) When running over a road with considerable grades we now have the possibility of working the motors at different torques corresponding to the different speeds, and still have the same output of the motors; that is, practically constant current. As is well known this is not the case with the series motor. When this motor increases its speed, not only the torque but also the output becomes less, and can be increased only by cutting out part of the field, an arrangement which is less satisfactory, as it often causes a liability of sparking. With the methods here described it is possible on the contrary to increase the torque above the normal over almost the whole range, if that should be considered desirable—for instance, in order to make up for lost time. This is shown graphically in Fig. 4, which shows a curve of torque and speed for a series motor and for a combination of polyphase motors. While the direct-current motor cannot at higher speeds develop torque above the curve "on loop," the alternating-current motors can at will momentarily develop anything up to the dotted line. When using this

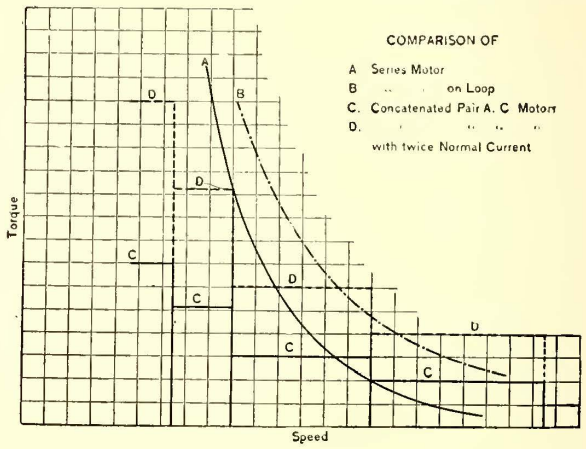


FIG. 4

system the task of the motorman will consist only in handling the controller so as to keep the current at a certain normal value, not only when accelerating, but also when running.

There is, however, one question more, which is fully as important as those already dealt with; namely, what is the economy in starting? This is the vital point for a considerable part of traction work projected just now. In order to see the result of the three-speed and four-speed arrangements in this direction, it is necessary to choose special cases—different combinations giving different economy. As an example take for the four-speed system two motors, one giving 2.5 times the speed of the other; for the three-speed arrangement, two motors, one giving 50 per cent more speed than the other, and compare the results of these combinations with the regular concatenated connection of two similar motors with the single motor and the direct-current series motor as to economy in starting. In order to find the relative economy we shall first consider the loss in secondary resistance outside the motors, that is to say, the loss if there were no losses in the motors themselves. When such an induction motor is brought up to full speed from standing still and with a constant torque, the input is exactly twice the output, that is to say, the loss in secondary resistance is equal to the amount of useful work. Generally if an induction motor with no losses in itself be brought up from a speed = n up to full speed = 1 with constant torque the ratio of input to output is $= 2/n + 1$.

Apply this formula to the different cases we find, if the useful work is unity, the input in electrical energy in the different cases:

1 : 0 The single motor $2/0 + 1 \quad 1 = 2$.

2 : 0 Two similar motors; concatenated connection used up to half of normal speed: Energy developed by motor up to half speed = ¼; accordingly

$$\frac{2}{0+1}\times\tfrac{1}{4}+\frac{2}{0.5+1}\times\tfrac{3}{4}=1\tfrac{1}{2}$$

3 : 0 Two motors with relative speeds 1 : 1.5; giving three speeds 0.4 : 0.667 : 1.

Energy stored up at these three speeds = 0.16 : 0.444 : 1 accordingly

$$\frac{2}{0+1} \times 0.16 + \frac{2}{\frac{0.4}{0.67}+1} \times (0.444 - 0.16) + \frac{2}{0.67+1} \times$$

$$(1 - 0.444) = 0.32 + 0.355 + 0.667 = 1.342.$$

4 : *o* Two motors with relative speeds 1 : 2.5 giving four speeds = 0.286 : 0.4 : 0.667 : 1. Energies corresponding to these speeds = 0.082 : 0.16 : 0.444 : 1.

Input accordingly

$$= \frac{2}{0+1} \times 0.082 + \frac{2}{\frac{0.286}{0.4}+1} \times (0.16 - 0.082) + \frac{2}{\frac{0.4}{0.67}+1} \times$$

$$\times (0.444 - 0.16) + \frac{2}{0.67+1} (1 - 0.444) = 0.164 + 0.091 +$$

$$= 0.355 + 0.667 = 1.277.$$

In order to compare these results with the economy in starting with direct-current motors we assume a series motor having no losses in itself; then the economy, when starting, is depending on the lowest speed at which we can obtain the full counter electromotive force. An assumption which corresponds fairly well to good engineering is that the full electromotive force is reached at a speed of two-thirds to three-quarters of the full speed. When connecting the motors in series this will accordingly correspond to a speed of one-third or three-eighths of full speed when the changing over from series connection to parallel is accomplished. Using the same formula as before which is here equally applicable we find input in electrical energy in order to obtain a useful work of unity:

1 : *o* Full voltage rendered by the motors at two-thirds of full speed. Energy required =

$$\frac{2}{0+1} \times \frac{1}{9} + \frac{2}{0.333+1} \times \left(\frac{4}{9} - \frac{1}{9}\right) + \left(1 - \frac{4}{9}\right) =$$

$$= 0.222 + 0.444 + 0.555 = 1.222.$$

2 : *o* Full voltage rendered by the motors at three-quarters of full speed. Energy required =

$$\frac{2}{0+1} \times \frac{9}{64} + \frac{2}{\frac{0.375}{0.75}+1} \times \left(\frac{9}{16} - \frac{9}{64}\right) + \left(1 - \frac{9}{16}\right)$$

$$0.281 + 0.562 + 0.437 = 1.281.$$

Comparing these results we find that neglecting the losses in the motors themselves, the economy in starting when using the combination of direct and differential concatenated connection, can be made very nearly the same as in direct current work, and that the three-speed concatenated connection gives an input of something like 6-7 per cent more, the regular concatenated connection with two similar motors an input of about 20 per cent more than the direct-current and four-speed alternating system, and finally the single alternating motor an input of about 75 per cent more.

Now taking into consideration the losses of the motors themselves in order to get a really fair comparison of the relative merits, we may assume the efficiency of the series motor and an induction motor at full load the same, say, 92 per cent—the efficiency of two motors in concatenation will then come to something like 82 per cent (or even 84 per cent, with a low periodicity, say twenty-five cycles); let us, however, assume only 82 per cent. If this is taken into consideration and the time during which the motors work with their different efficiencies, in different connections is also considered, we get the following results:

Electrical energy for starting up to full speed

1 : *o* The single alternating motor 2.17.

2 : *o* Two similar motors: concatenated connection used up to half of normal speed = 1.72.

3 : *o* Two motors with relative speeds 1 : 1.5, giving three speeds, 0.4 : 0.667 : 1 = 1.51.

4 : *o* Two motors with relative speeds 1 : 2.5, giving four speeds, 0.286 : 0.4 : 0.667 : 1 = 1.45.

5 : *o* Continuous current series motors operating in series up to one-third of full speed and resistance entirely cut out at two-thirds of full speed = 1.33.

6 : *o* Continuous current series motors operating in series up to three-eighths of full speed and resistance entirely cut out at three-quarters of full speed = 1.4.

In these calculations some factors of minor importance are neglected. Considering, for instance, the iron losses in the secondary of the induction motors when accelerating would make the figures slightly more favorable to the direct-connected series motors. On the contrary, it should be observed that there is an approximation in favor of the series motor to assume that connected in series they get up to fully half the speed, when connected in multiple with the same current. These approximations, however, will cause very small influence on the results obtained. Now, taking into consideration the energy which can be returned to the line by means of the alternating-current motors it is evident that also in this respect an advantage is obtained over the simple concatenated connection.

Taking the three-speed combination we find it possible to brake electrically and return energy to about 0.43 of the full speed, and with the four-speed combination down to about 0.31 of the same.

Theoretically it would be possible, when braking electrically, with the three and four speed arrangements to do it in steps, but as this would mean a slower stopping, reference is here only made to applying at once the full braking torque corresponding to the concatenation giving the smallest speed.

1 : *o* Single motor—no energy.

2 : *o* Two similar motors.

Braking down to about 0.54 per cent speed. Energy restored when braking from speed = n down to the least possible = n_1 with that connection = $2\,n_1/n_1 + n \times$ efficiency of motor acting as generator $\times$ energy taken from moving masses.

When using motors in concatenation for braking it must be borne in mind that it is not possible to obtain a negative torque until the speed has come down to a certain percentage of the full speed. This percentage is dependent on the resistances of the conductors and may vary considerably. For the purpose of getting a comparison it is here assumed that the electrical braking can begin at a speed of 0.9 of the synchronous speed.

In this case energy accordingly is taken from moving masses from 0.9 down to 0.54 of full speed. Accordingly if efficiency be taken = 0.82

$$\frac{2 \times 0.54}{(0.81 - 0.29) \times 0.34 + 0.9 \times 0.82 = 0.32}$$

3 : Three-speed motors as before. When braking connect immediately in concatenation so as to be able to use the same connection down to 0.43 of full speed.

$$\text{Energy restored} = \frac{2 \times 0.43}{(0.81 - 0.183) \times 0.43 + 0.9 \times 0.82 = 0.33}$$

4 : *o* Four-speed motors as before. When braking connect directly for being able to brake down to a speed of 0.31 of full speed.

$$\text{Energy restored} = \frac{2 \times 0.31}{(0.81 - 0.096) \times 0.31 + 0.9 \times 0.82 = 0.3}$$

The results so far obtained would correspond to reality in such cases where gearing is not made use of; if gearing is used, the loss therein should be taken into consideration. This loss can generally be estimated at about 5 per cent, it must, however, be borne in mind that in the case of differential concatenation it may amount to somewhat more, since the power transmitted through the gearing really is more than the resultant power. In the table below, where the results are brought together, this increased loss is, however, neglected. The table gives a comparison of the different systems as to input, the motors for starting up to full speed and electrically braking down as far as possible:

RELATIVE AMOUNT OF ENERGY CONSUMED.

	Accelerating Only		Accelerating and Electrically Braking	
	Without Gearing	With Gearing	Without Gearing	With Gearing
D. C. Motor, resistance entirely cut out at ⅔ full speed	1.33	1.4	1.33	1.4
D. C. Motor, resistance entirely cut out at ¾ full speed	1.4	1.48	1.4	1.48
A. C. Motor, simple	2.17	2.29	2.17	2.29
A. C. Motors regular concatenated connection	1.68	1.77	1.36	1.47
A. C. Motors, three speeds: 0.4; 0.67; 1.	1.5	1.58	1.17	1.27
A. C. Motors, four speeds: 0.285; 0.4; 0.67; 1.	1.45	1.52	1.15	1.24

Admitting that the polyphase motor as a rule is fully as efficient as the series direct-current motor, it may be considered that when working on an even road the difference in energy consumption will be negligible, then it would appear that by using the four-speed arrangements of concatenated connection it would be possible to get a more economical method of working electric roads than by means of the direct-current system with series motors. Considering at the same time that for greater distances the electric energy has to be generated as alternating current and then transformed into direct in converter stations, whereas with polyphase motors on the cars simply static transformers can be used giving a difference in loss of at least 5 per cent to 7 per cent in favor of the alternating-current motors, the comparison comes out still more in favor of these. An advantage also for them is that there is no need for high voltage in the rotating

parts of the motors; the rotor windings can be arranged for any desired voltage thus giving the designer full liberty to choose this so as to get the most convenient winding.

The author is fully aware of the drawbacks inherent to the alternating system such as the necessity of using a double trolley, the lag, etc., and admits that in many cases this system is entirely out of question on account of the double trolley, but for elevated roads and for underground works this matter hardly comes into consideration, and in many other cases the drawbacks of the alternating system will probably be more than counterbalanced by its greater economy.

One thing more should be mentioned. Probably it will be pointed out that there will be difficulties introduced by making one of the motors of 2.5 times the torque of the other. To this the author would reply that the best solution probably in many cases will be to connect in concatenation one motor with two or three others in parallel—for instance with a locomotive with four axles, have three of the motors of a slower running type than the fourth, and of a current carrying capacity something like one-third of this one. The same arrangement could be used for an ordinary double-truck car with four motors. For cars with only two axles the best arrangement will probably be with only three-speed connection, and then there will be very little difficulty—the difference in torque of the two motors not being so considerable.

Westeras, Sweden, Oct. 25, 1901.

A Car for City and Interurban Service

The car which is illustrated in the accompanying engraving belongs to a type which is not unusual. It is, however, intended for a city and interurban service, where the suburban feature usually requiring so much attention from the general management is entirely secondary to the interurban. The car is one built by the John Stephenson Company for the Camden, Gloucester & Woodbury Railway Company, and is part of a large order.

DOUBLE-TRUCK CITY AND INTERURBAN CAR

Although the body is but 26 ft. in length, it is divided into passenger and smoking compartments, the former having six, and the latter four windows on a side. The seats are all covered with spring cane. Those in the smoking room are longitudinal; those in the passenger compartment transverse and of the walk-over pattern. The short body was adopted because the traffic is not of the heaviest character, and a car of moderate dimensions answers every requirement. For this reason also only two motors are used for propulsion. The trucks are of the Stephenson type, No. 20. This style has a short wheel base, and on account of the improved arrangement of the springs is one of the easiest-riding trucks on the market.

The car is 36 ft. long over the dashers, 8 ft. 4 ins. wide over all, and 9 ft. from the under side of the sill over the trolley board. Each end has a completely enclosed vestibule, the doors of which close against the body of the car. The vestibule floor is dropped so that it may be reached from the ground by a single step. The roof is finished with street car bonnets. The bolsters are of iron, made according to the railroad pattern. The sills are plated with ½-in. x 6-in. steel. Truss rods under the side sills have a central bearing and are anchored at the bolsters. The bumpers are of the angle-iron pattern of ⅜-in. x 6-in. steel. The project 9 ins. in front of the dashers.

The vestibules have each a lamp and there are thirteen lamps within the car body. The inside lining, the partition and the doors are all of mahogany. The sash are also mahogany, those in the vestibule having metal stiles. A very stiff and strong floor framing has been given these cars. Angle-irons are used in the corners and heavy diagonal braces have been introduced. The sides are curved, giving the car the advantage of a narrow bottom frame. Inside the posts a high truss is used, covering up the window rail. There is in addition a truss plank against the posts, adding materially to the stiffness and strength of the curved sides.

The design is one likely to become popular for roads which connect small cities. The interurban features acquire especial prominence where there is a large proportion of long rides, as in such cases it is necessary to adopt the cars to the wants of the riders and make special preparation for their comfort.

American Street Railway Investments

The ninth edition of this well-known manual of electric railway properties has just been issued by the Street Railway Publishing Company. The arrangement of the book is the same as in the previous editions, the cities being arranged alphabetically, giving the best opportunity for ready reference. The book contains a large number of maps, many of them being in colors, showing the most important street railway systems in the United States. The statistics given are compiled from the reports of both operating and leased roads, and not only show all new roads that have been incorporated during the last year, but give the many important consolidations which have taken place. The date of information published is given in every case, and in some of the items is brought down as late as April 15. The "Red Book," as it is familiarly known, is the only publication which thoroughly covers the details of both the physical and financial conditions of electric railway properties, and it is valuable not only to street railway officials and managers and dealers in street railway supplies, but to bankers, capitalists and others interested in the construction or management of city and interurban lines.

A special meeting of the directors of the Sao Paulo Tramway, Light & Power Company was held at Toronto, Ont., recently, for the purpose of adopting a by-law increasing the capital stock of the company from $6,000,000 to $7,000,000. This increase was found necessary because of the growth of the company's business and its operations in Sao Paulo. The original capitalization contemplated the building and equipment of an electric railway in Sao Paulo, under the franchises which had been acquired by the company, and for the development of the water-power privileges at Parnahyba, the erection of power transmission lines and the purchase of right of way. As the undertaking progressed, the company further acquired, by purchase, the Electric Light Company, the Viacao (or mule road) and the Santo Amaro Railway. These purchases were not originally contemplated, but the wisdom of such a course has been vindicated by the results. It is now proposed to extend the company's electric railway lines, to add to the number of motor cars, to increase the capacity of the lighting and power plant, to provide additional transmission lines from Parahyba to Sao Paulo, and a second pipe line at the hydraulic plant. These extensions and improvements are estimated to cost about $750,000.

Interurban System for Louisiana

The announcement is made that the New Orleans & Southwestern Railway Company, which for a year past has been quietly perfecting plans for building its proposed new electric railway to extend from Montegut to Hahnville, is about to begin work on the line. The road will be 71 miles in length, and will connect at Hahnville with the Illinois Central Railroad. The plan of the company is to operate both passenger and freight cars, also Jim Crow cars. Aside from railroading, the company intends to supply light and power in towns along the route of the line. Bryan, Haynes & Turner, of Memphis, Tenn., have been awarded the contract for building the roadbed of the new line, and the Safety Electrical Manufacturing Company, of New Orleans, has been awarded the contract for supplying the overhead work. Six Heine boilers have been contracted for, and the Fulton Iron Works, of St. Louis, has been given the contract for three cross-compound condensing engines. The Bullock Electric Company, of Cincinnati, has been awarded the contract for the generators for the power houses, while the switchboard apparatus will be supplied by the Safety Electrical Company, of New Orleans. Plans are now being made in New Orleans for all houses necessary—general offices, power house, car house, shops, passenger and freight depots—in Thibodaux, Schriever, Houma, Montegut, Vacherie and Hahnville, and two sub-stations between Thibodaux and the Mississippi River and one between Thibodaux and Montegut. A bridge is to be erected over Bayou Lafourche in accordance with specifications from the War Department in Washington. It will be a drawbridge, operated from the power house. The general offices will be two stories high, built of brick. Their dimensions will be 60 ft. x 40 ft., containing all necessary offices and also an independent telephone station. The power house is also to be of brick, dimensions 180 ft. x 100 ft. The other buildings are to be of corrugated iron. The officers of the company are: C. P. Shaver, president; Thomas A. Badeaux, secretary and attorney; L. H. Lancaster, treasurer; C. P. Young, general manager; C. P. Shaver, J. Whitney Beals, Jr., L. H. Lancaster, Thomas A. Badeaux, Dr. H. S. Smith and C. P. Young, directors.

Consolidation at Norfolk

The plan to consolidate the street railway, lighting, heating, ice factory and kindred interests at Norfolk, Va., and neighborhood has been agreed upon. This merger embraces a control of the interests of this character in the cities surrounding Hampton Roads. There are twelve companies to be consolidated: Newport News & Old Point Railway & Electric Company, Citizens' Railway, Light & Power Company, of Newport News; Norfolk & Atlantic Terminal Company, Danville Railway & Electric Company, Newport News Gas Company, Distilled Ice Company, of Newport News, Norfolk Railway & Light Company, City Gas Company, of Norfolk; National Gas Company of Berkley; Berkley Street Railway Company; Portsmouth Electric & Gas Company, of Norfolk; Portsmouth & Newport News Railway Company. The companies embrace seven electric railway systems owning and operating 120 miles of trackage and occupying the principal streets of Norfolk, Portsmouth, Newport News, Hampton, Phœbus, Old Point, Berkley, Pinner's Point, Lambert's Point, Port Norfolk and South Norfolk, covering three cities and eight towns around Hampton Roads. There are also six ferry lines, five electric lighting plants, two ice plants and two gas companies, in addition. The consolidated company will own three seaside resorts, with hotels, bath-houses and pavilions. The new name of the company will be the Norfolk, Portsmouth & Newport News Company. Its total capitalization will be $9,000,000. Alexander Brown & Sons and J. William Middendorf & Co., of Baltimore, and John L. Williams & Sons, of Richmond, Va., are financing the consolidation.

Seeing Boston by Trolley

Special observation-car service similar to that of the Washington Traction & Electric Company, of Washington, D. C., and the Denver City Tramway Company and other companies is being operated in Boston. The cars leave Church Street, opposite the Public Garden, for two trips daily, one starting at 10 a. m., the other at 2 p. m. The time consumed in seeing the sights is about two hours, and the route covers all the important and interesting parts of original Boston, Charlestown, Somerville Brighton, Cambridge and Brookline. It passes Bunker Hill Monument, traverses the battlefield of Bunker Hill, passes on three sides of the grounds and buildings of Harvard University, and threads through the most beautiful residence section of the city. A guide starts with each party, and tells the story of public buildings, ancient and modern history of Paul Revere, of "Old Ironsides" at the Charlestown Navy Yard, and the sacking of the Ursuline Convent; in turn points out the Cambridge houses where Longfellow, Lowell and other famous men have lived, Mount Auburn Cemetery, where they lie buried; the Bethany Sunday-school and the Boston Public Library—in short, indicates all the points of interest. Signs reading, "Seeing Boston," are displayed conspicuously on the front and sides of the cars.

Annual Meeting of the American Institute of Electrical Engineeers

The annual meeting of the Institute was held on the evening of Tuesday, April 20. The meeting was largely attended, and two interesting papers on alternating-current electric traction were presented and discussed. One of these papers entitled "A Novel Combination of Polyphase Motors for Traction Purposes," by Ernst Danielson, is printed in full elsewhere in this issue, and the other, "Some Notes on European Practice in Electric Traction with Three-phase Alternating Currents," will appear later. The report of the Board of Directors for the fiscal year ended April 30, 1902, showed a total membership of 1549, a net gain of 239. The following officers were elected: President, Charles F. Scott; vice-presidents, C. O. Mailloux, Bion J. Arnold, Schuyler S. Wheeler; managers, Townsend Wolcott, Gano S. Dunn, E. H. Mullin, Charles A. Terry; treasurer, George A. Hamilton; secretary, Ralph W. Pope.

Railway Activity in South Dakota

The matter of electric railway construction in South Dakota is receiving a great deal of attention this spring, and while there is no doubt much discussion that will result in little active work, a great number of projects have been favorably mentioned. The most important move in this direction is another effort to secure a complete electric system of street railways for Sioux Falls, the principal city of the State. Several promoters have been attempting to secure franchises in that city but have ruined their prospects by rivalries among themselves, and the field is now open for a new organization to get to work. Such a one has been projected by local men. It is proposed to utilize a large milling property, at the falls of the Sioux River, the intention being to furnish electric power to the city generally as well as to operate a street car system.

Another move is the proposed line through Clay County, from Vermillion to Wakonda, which is being pushed by local promoters at Vermillion, who claim to have the funds arranged for.

A line, about six miles long, in Hanson County, is also contemplated. This road will run from Spencer to Epiphany, where Father Kroeger, who is the promoter, is conducting a sanitarium. If he decides that the line would be a paying investment he has the funds for its construction, and can build it at any time.

John H. King and other promoters of Huron are looking up the matter of a line from Redfield, in Spink County, to the northeast, connecting a number of towns, but this has not yet gone further than the discussion stage, although, with the rapid development of that section which is going on, they may be able to have definite plans made before the end of the year.

Damages Demanded for Noise Caused by L Trains

An important civil case has been assigned for trial by Chief Justice Mason, for June 9, in a jury-waived session of the Suffolk Superior Court at Boston. It is the action of Edward F. Baker against the Boston Elevated Railroad Company to recover damages on account of an injury to real estate occasioned by the construction and operation of the road.

It will doubtless be a test case in settling many questions of law likely to arise in this connection, and, as there are before the court actions for heavy damages the outcome will be watched with the closest attention, not only by the lawyers, but also by those who have claims of a like nature against the road. The amount of damages claimed in this particular case is comparatively small, and it has been selected in order to test the novel questions involved.

The principal question which will come up for the decision of the court will probably be that of whether the noise caused by the running of trains shall be taken into consideration in determining the amount of damages awarded. The road denies that this is an element to be considered.

The Everett-Moore Situation

There is still no change in the Everett-Moore situation so far as the traction interests are concerned. The bankers' committee has succeeded in disposing of two of the smaller telephone plants at good figures, in addition to the large plants at Dayton and Columbus, sold some time ago. The deal for the sale of the Toledo Railways & Light Company to J. & W. Seligman & Company, of New York, is off, and Messrs. Moore, Everett & Lang are in New York to consult with other parties who are negotiating for the property. There is nothing new relative to the Northern Ohio Traction situation, two parties still being anxious to purchase the road. The feeling is gaining ground that the syndicate is anxious to hold this property, and in event of the sale of the Detroit United interests it is thought that the Northern Ohio Traction will be retained, in which event it will be greatly improved to provide much faster service to Akron. Chairman Newcomb, of the bankers' committee, has gone on an extended vacation, and J. R. Nutt will represent the bankers in the negotiations for the sale of the railroads. Receiver Edwards, of the Detroit & Toledo Shore Line, has made application for permission to issue receiver's certificates to connect the west tracks of the Shore Line with the Detroit Southern at Trenton; also for authority to purchase locomotives and cars to operate a steam freight line. The other track is equipped for electricity, and through cars will soon be operated in connection with the Toledo & Monroe Railway.

The Indianapolis, Shelbyville & Southeastern Road

The Indianapolis, Shelbyville & Southeastern Traction Company is completing track-laying from the public square in Shelbyville to the city limits of Indianapolis, at which point the track will connect with the Indianapolis Street Railway Company's line. The company has utilized a force of 108 teams and 250 men on the work, and is ballasting the track as fast as the rails are laid. It will probably have the road in operation from Shelbyville to Acton by June 1. Cars will probably be running from Washington Street, Indianapolis, to the public square in Shelbyville by June 15. The power house is completed, the boilers, heater and condenser are all erected, and the engines and generators are now being installed. There is not a curve upon the road between the city limits of Indianapolis and the city limits of Shelbyville at a greater radius than 20 degs., in consequence of which cars can maintain a high rate of speed, and, it is thought, can easily make the run from terminal to terminal in one hour, as the cars are geared up to a speed of 52 miles an hour.

Regarding summer attractions on the line, in addition to the Acton camp grounds, which has for many years been visited every season by thousands of people, there is now being laid out 1 mile east of Acton picnic grounds of 40 acres. This tract of land has many natural advantages, being rolling land, partly covered with heavy timber and partly with shrubbery, and bordering on the banks of Buck Creek, which at this point is deep enough to provide boating for a distance of a quarter of a mile. It is the intention of the owner of this land to erect a large pavilion here for shelter and also build a summer theater and beautify the grounds extensively.

3000-Volt Trolley System

An interesting polyphase equipment at Neustadt, near Vienna, is described in *l'Industrie Electrique*. The plant has just been installed for the government arsenal, and it is proposed to connect the arsenal with the Schneeberg Railroad, two-thirds of a mile away. The arsenal already has installed a machine-shop driving plant, operating at 3000 volts and 42 cycles per second. It was decided, therefore, to apply this pressure directly to the railway line. The locomotive consists of a 36-kw 3-phase induction motor geared to the wheels and supplied with current from two trolley wires upon which the usual European bow trolleys are employed. The track is used as the third element of the circuit. The locomotive is provided with an air compressor for brakes and also for the operation of the controller, which is indirectly operated by compressed air. The locomotive greatly resembles those constructed by its makers, Ganz & Co., for the Valtellina Railways in Italy. The line has now been in operation about three months, and its successful working is considered to have demonstrated that the use of 3000 volts alternating current on a trolley wire is not only relatively simple and easy but also commercially economical.

London Letter

(From Our Regular Correspondent.)

The London & Brighton Electric Railway bill having been thrown out of Parliament, it is now stated that Mr. Behr, the inventor of the mono-rail and the promoter of the Manchester & Liverpool Electric Express Railway, which was sanctioned by Parliament last session, has been commissioned by a syndicate to prepare plans for a new railway on the mono-rail principle between London and Brighton.

The proposal to construct an electric light railway between Sandwich and Deal is assuming a practical shape. A joint committee of the two corporations interested has the matter in hand, and the Sandwich Town Council has agreed to the engagement of an expert to advise as to the possibility of carrying out the scheme, and as to its approximate cost. It is suggested that the proposed railway should run from Sandwich Quay, by way of the Sandhills, to the north end of Deal, and both towns will be equally benefited.

The Manchester Corporation has recently ordered from Mr. Markell E. Curwen 155 Brill trucks. This is the second order of Brill trucks for this corporation, and is for their No. 21 E type, with solid forged side frames.

The Manchester tramways committee has been requested by the gas officials to allow them to use the tramway poles for the purpose of street lighting. Gas mains would of course have to be laid to the base of the poles, and it is suggested that gas lamps could be suspended from special brackets which would be attached in some suitable and ornamental way to the poles. The electricity committee recently announced that the sanction of the Local Government Board had been given to the application of the corporation to borrow £477,000 for electricity purposes. The application formed the subject of an inquiry recently held by one of the inspectors of the Local Government Board.

The speeches delivered at recent meetings of railway shareholders indicate that the revenues of railway companies are being seriously depleted by the remarkable development of tramways in large cities. The companies are now endeavoring to meet this new and formidable competition by materially reducing their rates for local season tickets.

The passengers carried by the London United Electric Tramways during the Easter holidays showed a large increase over the previous year. The figures were as follows: On Good Friday, 143,782, as compared with 119,565 in 1901, or an increase of 24,217; Easter Monday, 261,418, as against 164,390 in the previous year, or an increase of 97,028, making a total increase for the two days of 121,245. On the last August Bank Holiday the passengers numbered 218,000, or 43,418 less than the figures for Easter Monday.

Leeds and Bradford have been united by a tramway, and the journey between the two cities can now be accomplished by electric cars in about one and one-quarter hours. Time tables have been exchanged between the Leeds and Bradford Corporations, who run the cars. From Leeds drivers are allowed forty-eight minutes to reach Stanningley, the midway station. The fare to Bradford is sixpence, payable in six stages. The railway companies charge ninepence. Expresses do the journey between the two cities in seventeen minutes, though the average time by rail is about half an hour.

The British Thomson-Houston Company, Ltd., of Rugby, has obtained the contract for 205 electrical equipments for the cars of the Manchester Corporation tramways. The 205 equipments represent 410 electrical motors of the G. E.-52 and G. E.-54 type, the controllers being B.-3 type.

The London, Brighton & South Coast Railway does not propose to allow anyone else, if it can prevent it, to make an electric railway from London to Brighton, and Mr. W. Forbes, the general manager, has recently stated that when the time is ripe, and as soon as they are convinced that an electric system can be produced capable of running trains at a high speed over a 50-mile track, they will adopt it at once. Meantime their electrical advisers, Mr. Philip Dawson and Major Cardew, are watching every detail of the progress of electric traction, and in next session of Parliament they will apply for powers to erect electric generating stations for their whole system, so that as soon as they decide to go ahead they will be able to do so without unnecessary delay.

There seems to be now a probability that the city of Belfast may enjoy electric traction within a reasonably short time, the City Council at a recent meeting having appointed a special committee to negotiate with the Belfast Tramway Company for the acquisition of their property. This resolution was adopted: "That as the corporation is entitled to purchase the Belfast street tramways in August, 1907, on the terms fixed by act of Parliament, the Council in committee are of opinion that if they can be purchased

by agreement in the meantime on a fair and equitable basis it would be desirable to do so, or, failing any such agreement, on the basis of the actual value of the lines, plant and good will, to be fixed by an arbitrator under the act, with a full allowance for the profits which might be earned by the company during the residue of their term. The amount fixed for the good will in the act of Parliament is 'a sum not exceeding £3,000.' "

At the annual meeting of the City of Birmingham Tramways Company, Ltd., Mr. James Ross stated, among other things, that the results of the working of the Bristol Road line, in converting which to the overhead electric system the company spent a good deal of money, were turning out very satisfactory. That line was worked on the new system for seven and a half months up to the end of December, and the net earnings were about £8,000, whereas under the old storage battery system it was hard work to make expenses.

The select committee appointed by the House of Lords to consider the London railway bills has now entered upon its work. Fourteen of the bills, which were deposited at the commencement of the session, now remain, viz., the Charing Cross, Hammersmith and District Electric Railway (two bills), City and North-East Suburban Electric Railway (two bills), King's Road Railway, King's Road Railway (Putney extension), North-East London Railway (two bills), Piccadilly and City Railway (two bills), West and South London Junction Railway, London United Electric Railway, Brompton and Piccadilly Circus Railway (new lines, etc.) and the Central London Railway (new lines).

Lord Windsor is chairman of the committee, and the other members are the Marquis of Bath, Earl Lauderdale, Viscount Knutsford and Lord Zouche, of Haryngworth.

The Hastings Corporation has refused to assent to a bill, promoted in Parliament, by Mr. W. M. Murphy, for power to construct a tramway line on the sea front, the following amendment being carried: "That this Council declines to entertain applications for their support to the Hastings Tramway Extension bill until the outbound tramways, for which parliamentary powers have already been obtained, have been constructed."

The formal opening of the new electric tramway system constructed by the Burnley Corporation took place recently. Last year the corporation acquired the undertaking of the Burnley & District Tramways Company, the purchase price being £53,000. A 4-ft. gage was adopted, and the corporation has been enabled to lay a double track almost the whole of the distance of 7½ miles from Padiham right through Burnley and on the Nelson. The corporation has laid the line and made the new roadway under the superintendence of their own officials, the only contract work being the electrical equipment and the cars. Twenty-four cars have been purchased, and it is intended to run a five minutes' service throughout the greater part of the day. It is expected that the cost of the undertaking will be about £110,000, which, with the sum paid to the old company, will make in all about £160,000.

In pursuance of the series of Glasgow Corporation lectures, Mr. John Young, the general manager of the tramways, delivered a most interesting lecture on the Glasgow system in the Berkeley Hall. Mr. Young sketched the earlier history of street locomotion, and demonstrated his points of comparison by an interesting series of slides. In dealing with the tramways of the city, Mr. Young showed the results that had been obtained by the old horse car system, pointing out how the revenue had increased from £222,000 in 1894-95 to £484,000 for the last financial year. He estimated that for the present financial year the revenue would reach £600,000. He stated that a very striking increase had also taken place in the number of passengers carried. The number carried by the Tramway Company in 1894 was 54,000,000, and the number carried last year was nearly 133,000,000.

At a reeent meeting of the tramways committee of the Darlington Town Council it was unanimously decided to recommend the overhead system. The estimated cost of the lines, which extend about 5 miles, without allowing for old material, the existing car house, rolling stock, horses, etc., and without including the purehase price of the old tramways, £7,500, was stated at about £90,000. If it were made a double line throughout under like conditions, the cost would work out to about £99,000. If £100,000 were borrowed, the interest on that amount at 3½ per cent, repayable over a period of forty years, the cost for interest and liquidation would be £4,682 14s. per annum. A penny rate in Darlington produces £814 net, but it is hoped that the receipts from the tramways will before long cover the cost.

The Corporation of Brighton is threatening to invade the sea front of that popular city by the sea, and newspapers are already up in arms against what some of them term vandalism. True it is that the esplanade at Brighton is a world-famous promenade, but how it could be utterly ruined by a well-constructed electrie tramway line on the side of the road next the sea is rather a stretch of imagination. It would at least perhaps assist in doing away with the row of antiquated cabs which daily stand there, much to the detriment of the sanitary condition of the road.

Electrical power equipment of the new workshops at Khargpur for this railway has been ordered from D. Bruce Peebles & Co. The order includes eighty motors of an average size of 15 bhp, and will, when completed, be one of the largest power installations. The same concern reports an exceptionally heavy trade in motors for power development, having at the present moment on order an equivalent to 20,000 hp for every variety of power transmission, both for colonial and home orders.

A. C. S.

Street Railway Patents

UNITED STATES PATENTS ISSUED MAY 13, 1902

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

699,640. Trolley Head or Wheel; G. Aye, Kittanning, Pa. App. filed Sept. 28, 1901. Three wheels are mounted on the trolley head in such a way that their rims will form the three boundaries of a triangular space for the wire.

699,643. Controlling Attachment for Trolley Poles; R. J. Barry, Westboro, Can. App. filed Dec. 10, 1901. The trolley pole is prevented from flying above the wire when the wheel runs off by a spring which connects the pole with the roof of the car and opposes the main spring of the arm.

699,651. Electric Heater; M. C. Burt, Chicago, Ill. App. filed Oct. 30, 1901. The heating resistance is placed around the outside of a perforated tube, and air under pressure is sent through the tube and the perforations to create circulation.

699,744. Trolley Wheel; G. E. Chapman, C. L. Ensign and J. J. Weir, Cleveland, Ohio. App. filed July 16, 1901. The contact device between the harp and the wheel makes both tangential and lateral contact.

699,769. Street Car Fender; A. W. Shank, Detroit, Mich. App. filed May 13, 1901. The front of the fender is held elevated by chains, which pass around a drum or staff. The motorman is thereby able to raise and lower it at will.

699,842. Reversible Guard Finger Clamp for Brake Beams; C. F. Huntoon, Chicago, Ill. App. filed Feb. 18, 1902. A guard finger clamp for brake beams formed with plurality of sockets for the reception of the guard finger and a seat for a member of the brake beam and means for clamping the guard finger in either of the seats, and coincidently securing the device in position on a brake-beam member.

699,862. Finger Guard for Brake Beams; C. H. Williams, Jr., Chicago, Ill. App. filed Feb. 12, 1902. The guard finger passes through an opening in the flange of the beam, and its extremity is fastened to the web of the beam, the beam thereby supporting it at two points.

699,902. Rail-Bond Construction; E. G. Thomas, Cambridge, Mass. App. filed Nov. 1, 1901. The bond passes through the web of the rail, the ends being fastened to the opposite sides thereof.

699,929. Finger Guard Clip for Brake Beams; J. T. W. Rudesill, East St. Louis, Ill. App. filed Oct. 21, 1901. The clip is of such construction that it may be readily applied to the brake beam or disconnected therefrom.

699,927. Trolley; P. McCullough, Tuebrook, Liverpool, Eng. App. filed June 24, 1901. A construction by which the trolley head can separate from the pole without injury to the wire when an exceptional pull is applied, as when the head gets entangled.

699,951. Electric Conrtoller; J. C. Henry, Denver, Col. App. filed April 1, 1901. The method of operating a pair of electric motors, which consists in connecting the armatures in series relation and the fields in shunt thereto, changing the combined machine to parallel and then speeding up by placing the fields of both motors in series.

699,981. Arch Bar; T. C. Salveter, St. Louis, Mo. App. filed Sept. 16, 1901. An arch bar for truck frames, consisting of upper and lower members and a spring seat, all formed in one casting and provided with reinforcing flanges.

699,986. Car Fender; W. Sullivan, St. Louis, Mo. App. filed July 15, 1901. Details.

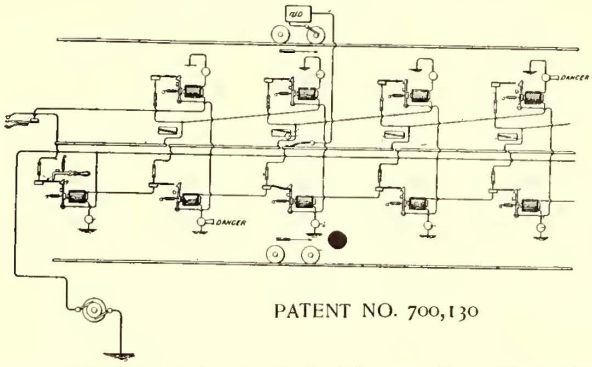
700,052. Electric Motor Car or Locomotive; C. De Kando, Budapest, Austria-Hungary. App. filed April 13, 1901. To enable a car to be operated by high-tension currents with safety, all of the conductors and parts which carry the current are encased in metallic tubes and covers, which are grounded.

700,126. System of Electric Railways of the Sectional Type of Conductors or Rails; C. J. Kintner, New York, N. Y. App. filed Dec. 2, 1901. Utilizing a part of the working current taken from a live section over which a car is passing, to prevent any circuit be-

tween a sectional conductor immediately in the rear of the live section and the current feeder, until the car has passed out of the section of which it is located.

700,127. Electric Railway; C. J. Kintner, New York, N. Y. App. filed May 6, 1901. This invention comtemplates lowering the current-flow through the terminals of a switch at the time that the corresponding sectional conductor is disconnected from the current feeded, to such an extent as to avoid injurious arcing.

700,128. Electric Railway; C. J. Kintner, New York, N. Y. App. filed May 6, 1901. A safety system in which cars are automatically prevented from approaching each other to a certain distance, and in which drawbridges are prevented from opening after a car has approached within a certain distance of it.



PATENT NO. 700,130

700,129. Electric Railway; C. J. Kintner, New York, N. Y. App. filed May 6, 1901. Signals are arranged to be operated coincidently with the energizing and de-energizing of the sections of a third rail, to thereby indicate to motormen the position of cars with respect to the sections.

700,130. Electric Railway; C. J. Kintner, New York, N. Y. App. filed Dec. 5, 1900. A safety system wherein the current to the sections immediately ahead and behind a car is controlled and co-operating signals likewise operated. The invention also relates to the manual control of current to the sections.

700,134. Trolley; M. P. Crcahan, Pittsburg, Pa. App. filed Oct. 25, 1901. The trolley wheel is spring-mounted at the end of the pole.

ENGINEERING SOCIETIES

NEW ENGLAND STREET RAILWAY CLUB.—The regular monthly meeting of the club will be held at Room 22, Walker Building, Massachusetts Institute of Technology, Boston, on Thursday evening, May 29. The speaker of the evening will be Professor W. L. Puffer, of the Institute.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—An extra meeting of the Institute will be held at the house of the American Society of Civil Engineers, 220 West Fifty-Seventh Street, on Wednesday, May 28, at 8:15 p. m. The general topic for the evening will be "Electricity in the Army and Navy," and many interesting papers are promised.

PERSONAL MENTION

MR. P. A. B. WIDENER and Mr. William L. Elkins will sail for Europe May 28, to be gone probably the entire summer.

MR. A. K. BAYLOR, formerly connected with the railway department of the British Thomson-Houston Company (Ltd.), and now interested in the British Electric Car Company, is at present on a visit to the United States. He may be found at his office in the Bowling Green Building, or at the Hotel Albermarle.

MR. JAMES F. MANN, formerly president and manager of the Utica & Mohawk Railroad Company, of Utica, N. Y., died at his home in that city a few days ago. Mr. Mann was born in Utica, and had devoted all of his energies to the interest of the city. He was one of the organizers of the Wood & Mann Steam Engine Company, which discontinued business after operating for twelve years. It was in 1885 that Mr. Mann became interested in street railway work, and he was prominently identified with the company in his home city until the property was sold, about a year ago.

MR. W. R. W. GRIFFIN has resigned as chief engineer and superintendent of motive power of the Lake Shore Electric Railway Company, of Cleveland, Ohio, to accept the position of electrician and superintendent of construction of the Rochester & Eastern Railway, of Rochester, N. Y., which is about to build an electric railway extending from Rochester. Mr. Griffin is an expert electrician and interurban railway authority, and was chief engineer of the Toledo, Fremont & Norwalk division of the Lake Shore Electric Railway when it was owned by the Comstock syndicate. Mr. Griffin was presented, a few days ago by his associates, with a handsome gold watch as a slight token of their esteem for him.

MR. A. LOCHERER, engineer of the Municipal Railway, Mr. Felix Roussel, member of the Paris Municipal Council, and Mr. F. Bienvenue, chief engineer of the bureau of bridges and roads of Paris, France, who are in the United States to study American railway practice, were the guests last week of Mr. George J. Kobusch and the officers of the East St. Louis & Suburban Electric Railway Company. The gentlemen and Messrs. Haynes and Bramlette, of the road, boarded a special car of the Suburban and made the trip from Belleville, a distance of fourteen miles from East St. Louis, in half an hour. Messrs. Locherer, Roussel and Bienvenue expressed themselves as particularly well pleased with the East St. Louis system, it being one of the most complete lines in the country, they said. They inspected the New York Rapid Transit Subway on Wednesday, May 21, and sailed for Europe on Thursday, May 22.

MR. E. C. FABER, the retiring general superintendent of the Cleveland Electric Railway Company, was presented with a loving-cup before leaving Cleveland by his old employees, the presentation ceremony being held in a hall hired for the purpose. Mr. Faber is probably the youngest superintendent in this country having charge of a property of any size at all commensurate with that of the Cleveland Electric Railway, and the many expressions of good will and appreciation of his ability that were given to him by his old employees before he left were very gratifying, not only to the recipient, but to his many friends in the management, who had placed him in control of the road's operation. Mr. Faber has not yet decided what business connections he will make in the future, although he has already had some good offers, but as he has devoted all his life to the operation of street railways he will probably remain in this field.

E. C. FABER

MR. C. LOOMIS ALLEN, who, as previously announced, has been appointed general manager of the Utica & Mohawk Valley Railway Company, of Utica, N. Y., succeeding Mr. J. J. Stanley, who has been appointed general manager of the Cleveland Electric Railway Company, assumed his new position on May 15. Mr. Allen has been connected with the Utica & Mohawk Valley Railway Company for about a year. He has been acting in the capacity of chief engineer of the extension now being constructed between Herkimer and Little Falls mostly, although part of his time has been spent in securing the rights of way for the lines through the private property to the west of Utica. Mr. Allen, as is well known, has been associated with electric railways for many years. He has been interested in the systems at Albany and Syracuse, and at the time that the Oneida Street Railroad was purchased by the Utica & Mohawk Valley Railway Company, he was at its head. He was also prominently identified with the Lorain Street Railway Company, of Lorain, Ohio.

MR. IRA A. McCORMACK, before leaving Cleveland to take up the duties of his new position with the New York Central & Hudson River Railroad, was given a luncheon by President Horace E. Andrews, of the Cleveland Electric Railway Company. The retiring general manager was warmly congratulated by the guests on his appointment to the position of assistant manager of the Mott Haven Division of the Central. Among those present were: Mr. W. C. Brown, third vice-president of the New York Central; Mr. Edgar Van Ettan, second vice-president of the New York Central, in charge of the Boston & Albany; Mr. C. E. Schaff, general manager of the Big Four; Mr. George P. Daniels, general traffic manager of the New York Central; Mr. A. J. Smith, general passenger agent, Lake Shore & Michigan Southern Railway Company; Mr. P. S. Blodgett, general manager of the Lake Shore & Michigan Southern Railway; Mr. A. H. Smith, general superintendent of the New York Central, and Mr. W. H. Marshall, general superintendent of the Lake Shore & Michigan Southern Railway Company.

FINANCIAL INTELLIGENCE

THE MARKETS

The Money Market

WALL STREET, May 21, 1902.

The strained and very perplexing situation of a week ago in the money market has suddenly straightened itself out. Various agencies, all of them set in motion by the extremely high rates exacted by local bankers, have contributed toward the process of relaxation, but the movement of relief has gone on much more rapidly than most authorities had expected. The heavy loans by foreign bankers have been the most conspicuous factor of the week. These credits simply represent the shifting of capital from Europe to this country as the more profitable field of employment. In their practical effect they release a certain portion of the outstanding loans of the New York banks, and by permitting a corresponding decrease in liabilities, provide a direct means for the increase of surplus reserve. Last Saturday's $23,000,000 reduction in the local loan account was chiefly brought about in this way. At the same time this was not the only influence bearing upon the loan movement. The completion of a number of syndicate transactions, requiring the temporary use of bank funds, had a good deal to do with the result, and speculative liquidation on the Stock Exchange was another although a minor influence. A great deal of pessimistic comment has been based upon the claim that in accepting the assistance of foreign capital so freely our market has merely been shifting its troubles of to-day upon the shoulders of to-morrorw. The truth is, of course, that with normal supplies of grain and cotton available for export, which we did not have a year ago, we shall have the means in three months' time to liquidate our foreign obligations that we do not possess now. Considering only the immediate outlook the extension of European credit has greatly hastened the work of relief, which given time would have been afforded from domestic quarters. The immediate effect of the high money rates prevailing a week ago was to raise New York bills of exchange at Chicago and other interior centers to a high premium, and thereby increase the flow of currency towards this center. This will probably show itself more largely in gains in cash holdings in the next one or two bank statements.

Money on call at the Stock Exchange has fallen to the normal level of 5 per cent. Time money is also decidedly easier, with 4¾@5 per cent quoted for all periods up to six months.

The Stock Market

The week's dealings in the general stock market have reflected a very positive divergence of speculative opinion upon the situation. There is no doubt that the decision of the coal miners to strike came as a very unpleasant surprise to a large contingent active in the market, including particularly the following of the Western operators. The indications are that these speculators suddenly closed out their commitments for the rise, and started out upon a campaign on the short side. This change of front, combined with the liquidation of the rank and file of small dealers on margin, caused a general decline in prices at the close of last week. But the downward movement was abruptly brought to a halt on Monday by the evidence that the actual selling had been exhausted. When the professional coterie endeavored to cover their short contracts they found only a scant supply of stocks available for the purpose, and in bidding up prices to bring out the necessary offerings the greater part of the previous losses were retraced. With the exception of the coal strike uncertainty, the general outlook has unquestionably improved, as compared with a week ago. The improvement in the money market position, which was a very important factor in speculative calculations, has already been described in detail. In addition to this the news from the crop regions has, for the most part, been highly favorable. The heavy rains of the last fortnight in the Southwest have materially bettered the condition of the winter wheat, while they have given an excellent start to the corn crop. In the Northwestern spring wheat territory the development is less favorable, an excessive rainfall having reduced the acreage planted to a considerable extent. Railway earnings continue to show up magnificently, and reports from the leading industries, despite the coal strike, are distinctly encouraging. The chances are, however, that until the termination of the coal troubles is nearer in view and until the harvests are further along toward maturity, that the stock market will continue somewhat narrow, with no very large fluctuations.

The local traction group has not been active in the week's trading. Following closely the course of the general list, these stocks fell off sharply towards the end of last week, and have regained their lost ground during the last two days. Brooklyn Rapid Transit was not affected by the poor earnings' statement submitted yesterday for the March quarter. Emphasis is laid on the point that the decrease in net earnings is due wholly to the policy of the new management in charging up improvements to operating expense, and a good deal is heard about big gains in traffic during the present quarter. But the real reason for the steadiness of the stock, as well-informed people are beginning to appreciate, is that the supply rests in the hands of people who are indifferent to present results, and are looking wholly to the future. The pressure upon Metropolitan shares appear to have ceased, for the present at least. In Manhattan the week's buying and selling have alike come seemingly from scattered sources.

Philadelphia

Dealings in traction stocks on the Philadelphia Exchange have been unusually light during the last week and scarcely anything worth recording has occurred. Whatever interest there was at all centered in the Union Traction movement The lease of the company to the Philadelphia Rapid Transit was officially ratified on Monday and will become operative on July 1. In the meantime the market for the stock has apparently "discounted" all there is at present in the way of speculative consequences from the deal. The shares are now being dealt in "ex" the rights to subscribe to the new stock. These rights, or warrants, are quoted in the market at 4, a decline of two points as compared with ten days ago. The final quotation for Union Traction stock ex-rights yesterday was 41, which, allowing for the value of the rights on a $50 par, would make the total cash value 43. This means a loss of a half point from the quotations of a week ago. The only other transactions for the week were a few sales of Philadelphia Traction at 97¾, American Railways at 46¼, Fairmount Park Transportation at 23, Germantown Passenger at 148 and Railways Company General at 5. As compared with the trading in stocks, that in bonds has been comparatively active. Consolidated Traction of New Jersey 5s, after an advance to 112⅜, fell back to 112 Indianapolis Railway 4s rose to 87 and then reacted to 86½, and Electric-People's Traction 4s, after selling as high as 99, dropped off to 98½. Other transactions included People's Passenger 4s at 106½, Citizens' Passenger of Indianapolis 5s at 109½ and Newark Passenger 5s at 118¼.

Chicago

The market for Chicago surface line stocks during the week has been generally dull and reactionary. Union Traction common is down more than a point, from 20 to 18¾, and the preferred two points, from 54 to 52. Largely this is the natural effect of speculative profit-taking, induced by the feeling that the recent advance measured very generously the improvement that has recently taken place in the company's earnings. The litigation over the ninety-nine year franchise matter is back in the federal courts again, and officials of the lines are hopeful of a favorable decision. Both the Union Traction and the City Railway have in mind extensive improvements as soon as the continuity of their franchihse is established. West Chicago shares on a few scattered sales went down from 98 to 95, and City Railway fell to 206 bid. Elevated stocks were irregular, with Lake Street up a point to 14 and Metropolitan common down from 40 to 39. The effort to form a union among employees of the surface lines is not as yet taken very seriously.

Other Traction Securities

The week has witnessed a decided revival of activity in Massachusetts Electric securities. The common stock, which sold at 43 a week ago, advanced on heavy buying to 45⅝, but at the higher level long stock came out in quantity and the price sank back to 44½. On moderate dealings the preferred rose from 96¾ to 97½. A few sales of Boston Elevated were reported at 164 and 163, of West End preferred at 115 and the common at 86. In the Baltimore market, interest centers chiefly around the United Railway income bonds, because of the well-defined report that a coupon will be paid on this issue in June. There appears to be little doubt that the company's earnings are in a condition to justify such a payment. The bonds referred to have reacted fractionally during the week to 71¼, and, moving sympathetically, the general mortgage bonds are down from 95⅜ to 95 and the stock from 16½ to 16¼. Other Baltimore sales comprise City Railway of Newport News 5s at 97, Norfolk Railway & Lighting 5s at 95 and 94 (both of which are associated with the extensive consolidation in that territory) and Lexington Railway 5s at 102½. North Jersey Traction is up a point on the bid price at 28. No change is re-

ported in Columbus Street Railway, which is quoted around 52¾ for the common and 107½ for the preferred. The active demand for Louisville Street Railway continues. At last accounts, although the bids were raised to 125 for the common shares, they failed to attract any further offerings. St. Louis Transit, on more active trading, went up a point to 32. Interest in the San Francisco securities dealt in on the New York curb has subsided. A hundred shares of the preferred sold yesterday at 59¾, which is a half point advance over the figure of a week ago. Quotations on the rest of the shares, however, are unchanged. One of the quietest weeks on record on the Cleveland Stock Exchange, so far as traction stocks were concerned. Small blocks of Detroit United, Western Ohio and Southern Ohio changed hands at stationary prices. Monday 200 shares Detroit United sold at 70⅞, a drop of one point from last sale.

Security Quotations

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

	Closing Bid	
	May 13	May 20
American Railways Company	46	46
Boston Elevated	164	163
Brooklyn R. T.	65⅜	65⅝
Chicago City	215	206
Chicago Union Tr. (common)	19¾	18¾
Chicago Union Tr. (preferred)	54	52
Cleveland City	106¾	..
Cleveland & Eastern	30	a30
Cleveland Electric	a83½	..
Columbus (common)	52¼	52¾
Columbus (preferred)	107½	107½
Consolidated Traction of N. J.	69¾	69½
Consolidated Traction of N. J. 5s	112	111¾
Detroit United	70⅜	70½
Electric-People's Traction (Philadelphia) 4s	98⅝	98½
Elgin, Aurora & Southern	36	38
Indianapolis Street Railway 4s	86¾	86½
Lake Street Elevated	13	12¾
Manhattan Ry.	131¾	131⅝
Massachusetts Elec. Cos. (common)	43	44
Massachusetts Elec. Cos. (preferred)	96¾	97
Metropolitan Elevated, Chicago (common)	39	38½
Metropolitan Elevated, Chicago	90½	89½
Metropolitan Street	147¼	148⅛
New Orleans (common)	33¾	33
New Orleans (preferred)	112	112
North American	122	120
Northern Ohio Traction (common)	33	30
Northern Ohio Traction (preferred)	83½	a85
North Jersey	27	28
Northwestern Elevated, Chicago (common)	a38	a38
Northwestern Elevated, Chicago (preferred)	a85½	..
Philadelphia Traction	97¾	97¾
St. Louis Transit Co. (common)	30¾	31½
South Side Elevated (Chicago)	a115	a115
Southern Ohio Traction	65¾	65½
Syracuse (common)	24	22
Syracuse (preferred)	62	64
Third Ave.	130	130
Toledo Railway & Light	20	18
Twin City, Minneapolis (common)	118¼	118
United Railways, St. Louis (preferred)	84	84¼
United Railways, St. Louis, 4s	87½	87⅝
Union Traction (Philadelphia)	43½	b41
Western Ohio Ry.	..	a22

* Ex-dividend. † Last sale. (a) Asked. (b) Ex-rights.

Iron and Steel

The scarcity of all classes of iron, from raw material to the finished product, continues to be a very pronounced feature. With production of pig iron proceeding at the rate of 18,000,000 tons yearly—which exceeds any previous high level—furnace stocks are reported down to less than 64,000 tons, or barely two days' supply. Some mills which make the intermediate and finished articles, have had to suspend on account of the lack of raw material, while relief is being sought more and more in all branches, through imports from abroad. Foreign-made steel billets "ex-ship" are quoted at $30 to $30.50 a ton, or $2 less than the domestic price. It looks, though, as if the present high premiums for early delivery will have to be paid for some time. Quotations are $21.50 to $22 for Bessemer pig iron, $33 to $34 for steel billets, $28 nominal for steel rails, and $33 to $33.50 for girder rails at mill.

Metal

Quotations for the leading metals are as follows: Copper, lake, 12¼ cents and 12½ cents; tin, 30⅛ cents and 30½ cents; lead, 4⅛ cents, and spelter, 4.45 cents.

DENVER, COLO.—It is said that over 78 per cent of the stock of the Denver City Tramway Company has been turned in under the plan for the merging of the company with the Denver & Northwestern Railway Company. Under this plan stockholders may take cash par value for the stock turned in before June 2, or they may take for every $500 of stock an equal amount of thirty-year 5 per cent first and collateral mortgage bonds and $125 of stock of the Denver & Northwestern Railway. By this plan Denver & Northwestern constitutes itself a holding company, issuing $6,000,000 bonds to take up the $5,000,000 stock of the Denver City Tramway.

EAST ST. LOUIS, ILL.—The $5,000,000 bond issue covering the East Side and the Eads Bridge Electric Railways has been over subscribed, and subscriptions sold in St. Louis last week at a premium of 5 per cent. Messrs. Clark & Company, of Philadelphia and New York, it will be recalled, acquired all of the properties mentioned about three months ago, and at that time announced that the lines would be operated as a whole, or constitute one system under one management. In other words, having acquired all of the lines, they would be consolidated, and they have since been operated in that manner. The purchase of the Clarks represented an outlay of about $4,000,000, according to Mr. Clark, at the time of the purchase. A bond issue of $5,000,000 was decided upon covering all of the properties, and subscriptions for the same have been received in four cities, $1,000,000 being allotted to St. Louis. The bulk of the remainder was subscribed in New York and Philadelphia, though some were also received in Chicago and Louisville. The bonds are of the denomination of $1,000, with interest at 5 per cent, payable semi-annually. The separate corporations are maintained for the present, and on last Tuesday the St. Louis & East St. Louis Electric Railway Company, commonly known as the Bridge Road, increased its capital stock from $200,000 to $500,000. The funds thus acquired will be used in improvements and extensions.

CHICAGO, ILL.—The Chicago Electric Traction Company reports earnings as follows:

Quarter ending March	1902.
Gross receipts	$18,464
Operating expenses	14,368
Earnings from operation	$4,096
Receipts from other sources	870
Gross income	$4,966
General expenses and maintenance	6,916
Net earnings	*$1,950

*Deficit.

WORCESTER, MASS.—The Worcester Consolidated Street Railway Company has called in $200,000 of the bonds of the Worcester & Suburban Street Railway Company. They are twenty-year bonds, paying 5 per cent and were issued in 1895, with a provision for their retirement after May 1, 1900.

BOSTON, MASS.—The West End Street Railway Company has presented to the Railroad Commissioners a petition asking for authority to make a new bond issue amounting to $300,000. It proposed that the bonds be dated Aug. 1, 1900, payable in fifteen years, with interest at 4 per cent, payable semi-annually. The date and terms would make the bonds fall due at the same time as a lot of bonds previously issued. The new bonds will be used to retire an outstanding issue of bonds bearing interest at 5 per cent.

DETROIT, MICH.—The Detroit United Railway Company reports earnings as follows:

April	1902.	1901.
Gross earnings	$258,051	$226,627
Operating expenses and taxes	150,719	131,888
Net earnings	$107,332	$94,739
From January 1 to April 30—		
Gross earnings	$1,009,536	$870,359
Operating expenses and taxes	586,374	497,630
Net earnings	$423,162	$372,729

MINNEAPOLIS, MINN.—Stockholders of the Twin City Rapid Transit Company have been notified of the increase in the issue of common stock, which was voted upon at the annual meeting May 6 and approved by the directors of the company the same day. This stock may be subscribed to by holders of common stock to the amount of 10 per cent of their holdings; the price to be $100 per share. Warrants for the right to subscribe to this stock will be issued to common stockholders of record at 3 p. m., June 2, 1902. The common stock already issued amounts to $15,010,000. This stock may be subscribed to any time between June 5 and July 1, 1902.

ST. LOUIS, MO.—The St. Louis & East St. Louis Electric Railway Company has filed with the Recorder of Deeds notice of an increase of its capital stock from $250,000 to $500,000.

ST. LOUIS, MO.—The St. Louis Transit Company's gross earnings for the month of April were $509,609, as compared with $464,454 in the corresponding month of last year. The total gross earnings from Jan. 1 to May 1 of this year were $1,889,860, as against $1,767,676 for the corresponding four months of 1901.

MANCHESTER, N. H.—It is reported that the New Hampshire Traction Company, incorporated in 1901 to take over the Exeter, Hampton & Amesbury Street Railway and its leased lines, also the Haverhill, Plaistow & Newton Street Railway, seeks control of all the street railways in southern New Hampshire as far north as Portsmouth and south to Lowell, Lawrence and Hudson, Mass. The fact that Howard Abel, formerly prominently identified with C. T. Yerkes in his Chicago and London enterprises, is president of the company tends to confirm the belief that the company will eventually operate on a large scale.

BINGHAMTON, N. Y.—The Binghamton Railway Company reports earnings as follows:

Quarter ending March 31	1902	1901.
Gross earnings	$41,574	$39,303
Operating expenses	29,094	26,340
Earnings from operation	$12,480	$12,963
Other income	656	559
Gross income	$13,136	13,522
Fixed charges	17,608	15,758
Net earnings	*$4,472	*$2,236

* Deficit.

SYRACUSE, N. Y.—The Syracuse Rapid Transit Railway Company reports earnings as follows:

Quarter ending March 31	1902	1901
Gross earnings	$170,333	$153,499
Operating expenses	97,272	86,200
Net earnings from operation	$73,061	$67,299
Other income	1,640	1,543
Gross income	$74,701	$68,842
Fixed charges	57,075	55,850
Net earnings	$17,626	$12,992

BROOKLYN, N. Y.—The Brooklyn Heights Railroad Company reports earnings as follows:

Quarter ending March 31	1902	1901
Gross receipts	$2,625,590	$2,650,235
Operating expenses	1,979,661	1,776,216
Earnings from operation	$645,929	$874,019
Gross income	67,371	65,463
Receipts from other sources	$713,300	$939,482
Fixed charges	1,061,766	1,144,420
Net earnings	*$348,466	*$204,938

* Deficit.

STATEN ISLAND, N. Y.—At the request of the holders of a large majority of the bonds and stocks of the Staten Island Electric Railroad Company and allied corporations, William Lanman Bull, R. Somers Hays, John Greenough and Walter G. Oakman have consented to act as a committee for the consolidation and reorganization of the Staten Island Electric Railroad Company, New York & Staten Island Electric Company, Richmond Borough Company, New Jersey & Staten Island Ferry Company, New York Investment & Improvement Company, and Richmond County Power Company. A plan for the consolidation and reorganization has been adopted, signed by the committee and lodged with the Guaranty Trust Company as depositary and is part of an agreement. Holders in majorities in value of the mortgage bonds and stocks have deposited their securities, and the committee has declared the plan operative and is now engaged in carrying it out.

STATEN ISLAND, N. Y.—The Staten Island Rapid Transit Company reports earnings as follows:

Quarter ending March 31	1902.	1901.
Gross earnings	$130,686	$112,570
Operating expenses	79,630	69,077
Earnings from operations	$51,056	$43,493
Receipts from other sources	4,639	13,453
Gross income	$55,695	56,946
Fixed charges	50,349	47,349
Net earnings	$4,346	$9,597

The general balance sheet shows cash on hand $67,399 and a profit and loss surplus of $110,692.

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company reports earnings as follows:

February	1902.	1901.
Gross receipts	$861,696	$843,394
Expenses, including taxes	716,432	584,461
Net receipts	$145,264	$258,933
Eight months ending February 28—		
Gross receipts	$8,395,448	$7,899,100
Expenses, including taxes	6,016,664	5,150,406
Net receipts	$2,378,784	$2,748,694

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company reports earnings as follows:

March	1902.	1901.
Gross earnings	$1,030,917	$955,503
Expenses and taxes	768,347	714,044
Net earnings	$262,570	$241,459
From July 1 to March 31—		
Gross earnings	$9,426,365	$8,854,604
Expenses and taxes	6,784,899	5,864,450
Net earnings	$2,641,466	$2,990,154

NEW YORK N. Y.—The Manhattan Railway Company reports earnings as follows:

Quarter ending March 31	1902.	1901.
Gross earnings	$2,878,236	$2,502,043
Operating expenses and taxes	1,400,378	1,348,136
Net earnings	$1,477,858	$1,153,907
Other income	121,937	200,287
Total income	$1,599,795	$1,354,194
Fixed charges	658,336	653,357
Balance	$941,460	$700,837
Dividends	480,000	480,000
Surplus	$461,460	$220,837
Passengers carried	58,037,249	50,448,918
From July 1 to March 31—		
Gross earnings	$7,808,661	$6,917,680
Operating expenses and taxes	4,117,478	3,925,544
Net earnings	$3,691,183	$2,992,136
Other income	514,511	595,211
Total income	$4,205,694	$3,587,347
Fixed charges	2,043,871	2,030,138
Balance	$2,161,823	$1,557,209
Dividends	1,440,000	1,440,000
Surplus	$721,823	$117,209
Passengers carried	157,560,097	139,569,870

ROCHESTER, N. Y.—The Rochester Railway Company reports earnings as follows:

Quarter ending March 31	1902.	1901.
Gross earnings	$264,659	$244,433
Operation expenses	146,932	161,882
Earnings from operation	$117,727	$82,551
Receipts from other sources	.....	1,771
Gross income	$117,727	$84,322
Fixed charges	74,374	71,589
Net earnings	$43,353	$12,733

LIMA, OHIO.—The Lima Electric Railway & Light Company has increased its capital stock from $500,000 to $850,000.

AKRON, OHIO.—The Canton-Akron Railway Company has executed a mortgage for $2,000,000 to the Knickerbocker Trust Company. A mortgage for $1,000,000, given a few months ago, was cancelled. Of the amount, $850,000 is reserved to retire the bonds of the Canton-Massillon Company, now owned by the same people, and $400,000 will be reserved for future improvements. The balance will be used for placing the road in operation. The bonds are for twenty years at 5 per cent.

CINCINNATI, OHIO.—A trust deed given to the Cincinnati Trust Company by the Rapid Railway Company has been filed for record. It covers a bond issue of $700,000, which money is to be used in the construction of the road. The issue is divided in 400 bonds of $1,000 denomination and 600 of $500 denomination, all bearing 5 per cent interest and payable within twenty-five years.

PITTSBURGH, PA.—Bonds to the amount of $2,500,000 will be issued by the Union Trust Company, of Pittsburgh, for the Pittsburgh & Charleroi Railway. The road, according to the agreement entered into last year between the Mellon interests and the Pittsburgh Railways Company, will be leased to the Pittsburgh Railways Company for 999 years as soon as it is completed.

PHILADELPHIA, PA.—The lease of the Union Traction Company to the Rapid Transit Company was executed May 19, when John B. Parsons, president, and J. B. Selfridge, secretary, of the Union Traction Company, and W. T. C. Sanders, president, and J. Edward Ryan, secretary, of the Philadelphia Rapid Transit Company, fixed their signatures to the instrument. Prior to the execution of the lease John M. Mack was elected director of the Union Traction Company to fill the vacancy made by the resignation of Thomas Dolan.

WEST CHESTER, PA.—A meeting of the stockholders of the West Chester Street Railway Company is to be held July 15 to vote on a plan to increase the capital stock of the company from $60,000 to $1,000,000, also to increase the bonded indebtedness from $30,000 to $1,000,000.

AUSTIN, TEX.—The Austin Rapid Transit Railway Company, which for the past several years has been in the hands of a receiver, Major Ira H. Evans, has been sold at foreclosure to F. H. Watriss, of New York, president of the company, for $100,000, which amount, in accordance with an order of the court, was the minimum price placed on the road. As soon as the sale is confirmed by the court it is the purpose of the company to reorganize.

SEATTLE, WASH.—The Boston News Bureau publishes the following report of the earnings of the Seattle Electric Company:

	1902	1901
Gross receipts	$1,383,286	$1,132,024
Net earnings	531,682	290,223
Fixed charges	247,825	209,510
Surplus	283,857	80,713

HULL, QUE.—The Hull Electric Railway, which was included in the purchase of the Ottawa, Northern & Western Railway system by the Canadian Pacific Railway Company, is to be sold to a syndicate of Canadian Pacific stockholders, but will not be operated in conjunction with the Canadian Pacific Railway.

TABLE OF OPERATING STATISTICS

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

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
AKRON, O.						
Northern Ohio Tr. Co.	1 m., Apl. '02	49,425	28,527	20,898	12,829	8,069
	1 " " '01	39,618	25,477	14,142	------	------
	4 " " '02	190,559	114,862	75,697	50,579	25,118
	4 " " '01	162,271	104,034	58,237	41,988	16,249
	12 " Dec. '01	617,011	* 350,845	266,166	136,162	130,004
	12 " " '00	513,725	* 317,475	196,249	141,133	55,117
ALBANY, N. Y.						
United Traction Co.	1 m., Apl. '02	117,072	81,527	35,345	23,603	11,941
	1 " " '01	109,838	75,982	33,856	19,901	13,955
	10 " " '02	1,215,771	837,766	378,005	215,823	162,181
	10 " " '01	1,141,026	775,467	365,559	199,433	166,126
BINGHAMTON, N. Y.						
Binghamton St. Ry. Co.	1 m., Apl. '02	14,843	9,841	5,002	------	------
	1 " " '01	13,994	9,220	4,774	------	------
	9 " " '02	155,621	85,026	70,595	48,498	22,097
	9 " " '01	140,084	75,794	64,290	44,384	19,906
BOSTON, MASS.						
Boston Elev. Ry. Co.	12 m., Sept. '01	10,869,496	7,336,597	3,532,899	2,896,359	636,539
	12 " " '00	10,236,994	6,828,110	3,408,884	2,932,839	476,044
Massachusetts Elec. Cos	12 m., Sept. '01	5,778,133	3,915,486	1,862,648	937,206	925,442
	12 " " '00	5,518,837	3,659,337	1,859,500	994,294	865,206
BROOKLYN, N. Y.						
Brooklyn R. T. Co.	1 m., Mar. '02	1,030,917	* 768,347	262,570	------	------
	1 " " '01	955,503	* 714,044	241,459	------	------
	9 " " 02	9,426,365	*6784899	2,641,466	------	------
	9 " " '01	8,854,604	*5864450	2,990,154	------	------
	12 " June '01	12,135,559	*7216008	4,919,551	4,341,748	577,803
	12 " " '00	11,768,550	*7106373	4,662,177	4,135,405	526,772
BUFFALO, N. Y.						
International Tr. Co.	1 m., Feb. '02	230,744	132,920	97,824	94,276	3,548
	1 " " '01	235,021	118,273	116,748	84,411	32,338
	8 " " '02	3,519,491	1,664,285	1,855,206	789,124	1,066,081
	8 " " '01	1,998,050	972,319	1,025,731	641,057	384,674
CHICAGO, ILL.						
Chicago & Milwaukee Elec. Ry. Co.	1 m., Apl. '02	13,057	5,899	7,159	------	------
	1 " " '01	10,443	5,584	4,859	------	------
	4 " " '02	44,749	23,603	21,146	------	------
	4 " " '01	34,041	22,614	11,428	------	------
Lake Street Elevated	12 m., Dec. '01	786,462	388,799	397,663	------	------
	12 " " '00	757,954	378,661	379,293	------	------
CLEVELAND, O.						
Cleveland & Chagrin Falls	1 m., Feb. '02	3,454	2,255	1,199	------	------
	1 " " '01	2,435	3,016	† 581	------	------
	12 " Dec. '01	47,976	* 32,002	15,974	13,023	2,951
	12 " " '00	49,646	* 33,272	16,374	13,294	3,080
Cleveland & Eastern	1 m., Feb. '02	4,916	3,616	1,300	------	------
	1 " " '01	3,525	4,037	† 512	------	------
	12 " Dec. '01	90,390	52,022	38,368	43,678	† 4,310
	12 " " '00	62,893	36,672	26,221	36,148	† 9,927
Cleveland El. Ry. Co.	1 m., Feb. '02	168,462	97,446	71,016	22,170	48,846
	1 " " '01	151,805	90,251	61,554	18,875	42,679
	2 " " '02	356,544	203,452	153,092	43,945	109,146
	2 " " '01	318,537	189,514	129,023	37,851	91,172
	12 " Dec. '01	2,296,898	1,265,953	1,030,945	244,231	786,714
	12 " " '00	2,061,505	1,121,037	940,467	258,483	681,984
Cleveland, Elyria & Western	1 m., Apl. '02	21,065	13,022	8,043	------	------
	1 " " '01	17,054	9,508	7,546	------	------
	4 " " '02	78,149	51,391	26,757	------	------
	4 " " '01	64,084	43,382	20,702	------	------
	12 " Dec. '01	249,260	136,865	112,394	57,023	55,371
	12 " " '00	179,698	102,393	77,304	34,562	42,742
Cleveland, Painesville & Eastern	1 m., Mar. '02	12,867	6,892	5,975	------	------
	1 " " '01	9,537	5,312	4,225	------	------
	3 " " '02	31,986	19,207	12,779	------	------
	3 " " '01	26,019	15,675	10,343	------	------
	12 " Dec. '01	164,971	* 87,102	77,869	72,500	5,369
	12 " " '00	141,112	* 89,592	71,520	72,500	† 980
DENVER, COL.						
Denver City Tramway Co.	1 m., Apl. '02	124,516	66,533	57,983	32,865	26,119
	1 " " '01	116,357	62,866	53,490	31,304	22,186
	4 " " '02	481,348	261,118	220,230	131,259	88,972
	4 " " '01	435,297	236,915	198,382	125,622	72,759
	12 " Dec. '01	1,507,293	818,321	688,965	383,180	305,785
	12 " " '00	1,302,290	722,458	579,839	374,291	205,548
DETROIT, MICH.						
Detroit United Ry.	1 m., Apl. '02	259,776	150,719	109,057	66,402	42,655
	1 " " '01	228,597	131,888	96,709	57,360	39,349
	4 " " '02	1,015,407	586,374	429,033	260,155	168,878
	4 " " '01	878,865	497 630	381 235	229,425	151,810
	12 " Dec. '01	2,919,171	*1596765	1,322,046	652,277	670,129
	12 " " '00	2,575,277	*1439058	1,136,219	616,468	519,751
Detroit and Port Huron Shore Line (Rapid Ry. System)	1 m., Apl. '02	29,611	18,392	11,219	10,568	651
	1 " " 01	28,877	18,062	10,816	9,692	1,124

Company	Period	Total Gross Earnings	Operating Expenses	Net Earnings	Deductions From Income	Net Income, Amount Available for Dividends
DULUTH, MINN.						
Duluth-Superior Tr.	1 m., Mar. '02	41,140	23,947	17,193	9,612	7,581
	1 " " '01	33,212	21,238	11,974	9,105	2,869
	3 " " '02	111,261	67,886	43,375	28,839	14,536
	3 " " '01	94,763	59,623	35,141	27,286	7,854
ELGIN, ILL.						
Elgin, Aurora & Southern Tr.	1 m., Apl. '02	29,642	19,595	10,047	8,333	1,713
	1 " " '01	26,613	18,285	8,328	8,333	† 5
	11 " " '02	344,136	195,674	148,462	91,667	56,795
	11 " " '01	300,962	192,726	108,236	91,667	16,569
HAMILTON, O.						
Southern Ohio Tr. Co.	1 m., Apl. '02	27,774	15,245	12,529	7,500	5,029
	1 " " '01	23,530	14,405	9,125	7,500	1,625
	12 " " '02	353,144	186,365	166,779	90,000	76,779
	12 " " '01	303,704	166,757	136,946	90,000	46,946
LONDON, ONT.						
London St. Ry. Co.	1 m., Apl. '02	9,942	6,395	3,547	2,335	1,211
	1 " " '01	9,496	5,999	3,497	1,998	1,499
	4 " " '02	29,188	26,723	12,465	8,896	3,569
	4 " " '01	26,192	25,136	11,056	7,807	3,249
MILWAUKEE, WIS.						
Milwaukee El. Ry. & Lt. Co.	1 m., Apl. '02	206,049	99,154	106,893	64,108	42,785
	1 " " '01	184,210	96,099	88,111	60,483	27,629
	4 " " '02	833,547	401,276	432,271	257,901	174,370
	4 " " '01	728,683	397,530	331,152	241,163	89,989
MINNEAPOLIS, MINN.						
Twin City R. T. Co.	1 m. Mar. '02	279,383	127,960	151,423	58,517	92,906
	1 " " '01	242,214	115,896	126,317	53,763	72,552
	3 " " '02	796,322	380,651	415,670	175,550	240,120
	3 " " '01	694,067	337,581	356,485	159,793	196,692
MONTREAL, CAN.						
Montreal St. Ry. Co.	1 m., Mar. '02	154,390	83,850	70,540	15,848	54,692
	1 " " '01	144,794	93,272	51,521	9,288	42,234
	7 " " '02	1,079,110	679,459	399,652	106,234	293,418
	7 " " '01	1,012,816	652,921	359,895	64,363	295,532
NEW YORK CITY.						
Manhattan Ry. Co.	3 m., Dec. '01	3,038,435	1,404,971	1,633,465	753,135	880,329
	3 " " '00	2,728,598	1,340,696	1,387,902	749,857	638,045
	12 " Sept. 01	10,455,872	5,328,649	5,127,223	2,682,132	2 444,091
	12 " " '00	9,950,735	5,195,312	4,755,423	2,688,644	2,066,779
Metropolitan St. Ry.	3 m., Dec. '01	3,887,936	1,723,972	2,143,964	1,151,140	992,824
	3 " " '00	3,786,030	1,699,649	2,086,381	1,138,467	947,914
	12 " June '01	14,720,767	6,755,131	7,965,636	4,534,068	3,431,567
	12 " " '00	14,437,134	6,631,254	7,805,880	4,445,720	3,360,160
OLEAN, N. Y.						
Olean St. Ry. Co.	1 m., Mar. '02	3,394	2,411	1,584	1,146	438
	1 " " '01	3,835	2,043	1,79	1,187	604
	9 " " '02	41,735	21 611	20,124	12,343	7,781
	9 " " '01	39,270	19,276	19,994	11,068	8,925
PITTSBURG, PA.						
Consolidated Traction	1 m., Dec. '01	304,669	140,941	163,728	91,548	72,180
	1 " " '00	277,439	109,069	168,370	89,807	78,563
	9 " " '01	2,649,656	1,145,651	1,503,905	807,667	694,238
	9 " " '00	2,471,696	1,013,240	1,458,456	799,704	658,752
PHILADELPHIA, PA.						
American Railways	1 m., Apl. '02	79,619	------	------	------	------
	1 " " '01	64,339	------	------	------	------
	10 " " '02	810,663	------	------	------	------
	10 " " '01	691,399	------	------	------	------
RICHMOND, VA.						
Richmond Trac. Co.	1 m., Sept. '01	20,991	15,669	5,322	3,196	2,126
	1 " " '00	20,727	10,770	9,957	3,843	6,115
	12 " " '01	218,569	139,542	79,027	38,618	40,410
	12 " " '00	203,057	108,198	94,859	37,608	57,250
ROCHESTER, N. Y.						
Rochester Ry.	1 m., Mar. '02	91,759	47,468	44,292	24,854	19,437
	1 " " '01	87,078	55,583	31,492	24,278	7,214
	3 " " '02	264,660	146,932	117,728	74,375	43,353
	3 " " '01	246,054	161,877	84,177	72,694	11,483
SCRANTON, PA.						
Scranton Ry. Co.	1 m., Oct. '01	2,638	29,300	adf26661	------	------
	1 " " '00	48,781	34,787	13,993	------	------
	10 " " '01	507,989	295,079	212,910	------	------
	10 " " '00	504,852	298,122	206,730	------	------
SCHENECTADY, N. Y.						
Schenectady Ry. Co.	3 m., Dec. '01	84,061	46,949	37,112	13,454	23,658
	3 " " '00	30,876	14,517	16,359	6,087	10,272
SYRACUSE, N. Y.						
Syracuse R. T. Co.	1 m., Mar. '02	60,253	33,607	26,646	19,025	7,621
	1 " " '01	55,101	30,206	24,895	18,677	6,218
	3 " " '02	518,644	285,559	233,085	171,171	61,914
	9 " " '01	459,972	252,436	207,536	167,605	39,931
TOLEDO, O.						
Toledo Ry. & Lt. Co.	1 m., Mar. '02	111,174	53,151	58,024	37,833	20,189
	1 " " '01	98,749	46,047	52,701	24,271	28,431
	3 " " '02	325,238	163,442	161,796	113,494	48,302
	3 " " '01	288,960	141,628	147,333	72,813	74,520
	12 " Dec. '01	1,311,084	* 636,407	674,677	415,168	259,509
	12 " " '00	1,182,517	* 616,945	565,572	409,051	156,521
W. NEW BRIGHTON, S. I.						
Staten Island Ry	3 m., Mar. '02	38,189	46,906	† 8,717	8,778	†17,495
	3 " " '01	35,897	38,288	† 2,391	8,217	†10,608