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EDITORIAL NOTICE

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Contents of this Issue

The Telephone in Railway Work

Much has been written about the use of the telephone in the operation of long-distanee railway lines as a convenient means of starting the ears or even as a substitute for a block signal system, but this week we describe a system of telephonic intercommunication between the offices, shops, power stations and car houses of a large street railway that shows how important this time-saving invention is to the city as well as interurban roads. The Brooklyn Rapid Transit Company has gradually developed a private service which in its present proportions would do credit to a small town, and one of the busiest departments in its main office building is to be found in the small room set aside as the telephone exchange. Here the operators are not only kept constantly employed during the day, in making outside eonnections, but they find a large part of their work in bringing together the various extensions of the private system. It may not be amiss here, therefore, to point out the saving to the company which would result in the installation of some automatic telephone system, whereby the employees of one department could communicate with those of another without the intervention of central unless an outside call was needed. Under the present conditions the firm grip which the local telephone companies have on that business in New York City would, of course, render it impossible to make any arrangement of conneeting the private instruments with the public system, but those few offices where outside calls are necessary cannot be very numerous and a small exchange with one operator would be quite sufficient to attend to the business. There have been automatic telephone systems perfected whieh can provide intercommunication for a much greater number of branches than are employed in any railway company, and managers intending to enlarge their telephone facilities would undoubtedly find it to their advantage to bear the subject of automatic exchanges in mind. By placing an instrument on the private system at the operator's elbow any message could be verbally repeated by her to the public system, so that the few calls coming in or going out might be made with but little delay or inconvenienee, although no direct telephonic connection between the two parties could be effected. As these calls would ordinarily be in the form of orders for supplies or instructions no great disadvantage would result from repeating the message. Automatic systems have been applied in single buildings, as, for example, in the handsome new repair shops of the Rhode Island Suburban Railway Company at Providence, where some eight or nine departments are connected, but we do not know of any complete railway system so equipped. In fact, a large number still depend on the public exchange for making eonnections between the main offiee and the power houses or other buildings. The rapidly increasing use of the telephones, however, as these roads inerease their facilities, will probably necessitate the installation of private wires, and when this oeeurs the advantage of the automatic exchange cannot be overlooked.

Trilby Rail for Chicago

From present appearances the city of Chicago is about to adopt as standard for street railway construction the "trilby" grooved rail with wide groove and broad lip, as used in New York City. In view of the excellent results with T-rail in Minneapolis, Denver, Los Angeles and other cities this choice seems to be unfortunate. An effort was made to secure the adoption of T-rail, but the Council committee on transportation has voted in favor of the trilby grooved rail.

It is one of the peculiarities of the governing bodies of many cities that they consider or seem to consider that anything which is done by the street railway companies of New York City should be adopted without change in their own jurisdictions. The citizens of many Western cities profess to have a profound scorn for many of the ways of New York, as being un-American, but this evidently does not apply to its street railway system. This is certainly a compliment to the Metropolitan Street Railway Company, but we believe that the officers of that company would be the first to disclaim the

idea that its practice is to be recommended in every particular to the needs of other cities. The service in New York is peculiar, and the standards adopted there were selected for New York conditions alone, and while they are probably the best for such service they might, and in many cases would, be entirely unsuitable for other cases.

A Few Words About Three-Cent Fares

Some years ago, when figures on the cost of street railway operation and maintenance were not as well known or as easily available as now, there may have been more excuse for the proposition that 3-cent fares were feasible than at present when there is such a mass of facts and operating figures proving the fallacy of the idea. It has been gratifying to note that in all the agitation and discussion that has been going on in Chicago the past year in regard to terms of franchise extensions no serious consideration has been given to the proposition to require 3-cent fares, and it has by common consent been agreed that the 3-cent fare is out of the question if first-class service is to be given and tracks and equipment are maintained. However, that there are still some who think the 3-cent fare practicable is shown by the recent passage of the Cleveland ordinance for 3-cent fare lines, and also by the developments at Indianapolis. Without in any way questioning the good faith of those behind these 3-cent fare companies we cannot refrain from calling attention to a few hard financial facts as to cost of street railway operation that must be ignored before any large city street railway system operated in the United States on a 3-cent fare basis can be considered sound as a permanent investment, or in a position to give continuous good service. An examination of the financial reports of a large number of the street railways of the country demonstrates that but very few are able to show taxes and operating expenses as low as 2½ cents per passenger. The great majority are above this. We have not space to cite examples here, but plenty are available to all who care to investigate, and most of our readers know this statement as to cost is too low, rather than too high. Taking the cost as 2½ cents per passenger, it is evident that it is not reasonable to expect any great future reduction in the cost of carry each passenger, be the fare 1 cent or 10 cents. To haul passengers cheaper per capita would simply mean unbearable crowding of cars at all hours of the day. It simply then comes down to a question of how much interest, depreciation and sinking fund the ½ cent per passenger left above operating expenses will pay.

If the road carries 500,000 passengers per mile of track per year, as a few roads do in the largest cities, ½ cent per passenger would only pay 5 per cent on $50,000. Now, the cost of a road to properly handle 500,000 passengers per mile of track per year will be more than $50,000 a mile. On a 3-cent fare basis not only would nothing be left for a sinking and renewal fund (without which no road can expect to keep out of financial difficulties for many years), but the surplus over operating expenses would not even pay interest on actual construction cost. However, this is under the most favorable assumptions. At Indianapolis we understand that the present company in the field carries less than 300,000 passengers per mile of track per year. If this is the case ½ cent per passenger would yield under $1,500 a year per mile of track, or five per cent on $30,000. This would not only take no account of sinking fund, but would not even pay interest on the $37,500 per mile which it is proposed to put into a 3-cent fare road there. Incidentally, it might be said that a road costing, complete, $37,500 a mile, including paving and all equipment, to serve a city of 170,000 population, would be of the kind that would require the laying aside of considerably more than 10 per cent of the original cost each year to provide for the early reconstruction that would be necessary. Roads built at that price in a city of 170,000 are built to sell, not to operate.

Much is said by the advocates of 3-cent fares of being able to carry for that price because of having no water in the stock, but as long as taxes and operating expenses remain what they are it is seen from the foregoing that it is impossible to figure a profit for any long terms of years, even on the lowest legitimate cost of construction. That there has been overcapitalization, or in common parlance stock-watering, in connection with many street railway enterprises, as in other companies, cannot be denied, and it is unfortunate for the street railway business that this is so, for the public has been led to believe that a great proportion of the passengers' nickel goes to pay dividends on watered stock. Much of this feeling is probably due to the enormous fixed charges with which nearly every road in the country is burdened, and which are due, in a large measure, not, as the public supposes, to stock-watering, but to the necessity which has arisen of reconstructing the entire road and equipment several times within a period of fifteen years, because of the progress of the art and the insufficiency of early track and electrical apparatus. It must be a peculiar code of morals that fails to recognize the right of an investor to realize on money spent in such experiment and reconstruction when spent with the expectation that under the protection of a franchise some returns will be obtained after a number of years.

Motormen's Methods

The city electrician in a well-known Western municipality recently made certain recommendations and criticisms upon the electric car service in that city which were quite amusing, especially that part of the report pertaining to the methods used by motormen in handling cars. The recommendations stated, among other things, that there should be a correction in the method of stopping and starting cars; that the motormen were lazy, and to avoid all possible work on the brakes, were in the habit of shutting off the current some little time before the point where the brakes were applied. The report furthermore said that the men were guilty of gross negligence in not turning on current fast enough, as it took cars in the city in question nine seconds to attain full speed, whereas the electric cars in New York City commonly attain full speed in six and one-half seconds. Here, indeed, are some suggestions, and statements as to matters of fact, which are certainly unique. In the first place, what superintendent ever had any difficulty in getting his motormen to turn on the current fast enough? It is well known among those familiar with street railway management that the constant temptation is for a motorman to turn on the current too fast, with the result of jerking passengers and slipping of wheels. Any suggestion that the motorman who is required to make a fast schedule speed will fail to turn on the current as fast or faster than the comfort of passengers and the adhesion of the wheels to the rails will permit is absurd. In fact, there are not a few managers who have been laboring for years to remedy the evil of turning on current too fast, and not a few devices have been proposed to remedy the evil. That rapid acceleration is desirable in street and elevated railway practice has been prominently brought forward by the engineering calculations and discussions of the last five years, but that the ordinary street railway motorman, with schedule time to maintain, will fail to get this rapid acceleration wherever it is possible is too far from the facts of every-day practice to be considered in the light of anything but a joke. As to the alleged average figures on the time taken to accelerate a car from zero to full speed in New York City, and in the city which has been blessed with this report, there is evidently such a gross percentage of error in the observations that they are not to be considered any more seriously than the other statements in the report before mentioned. In the first place, it is not clear how the electric surface cars in New York City are to be accelerated from zero to a rate of 15 miles to 18 miles an hour in six and one-half seconds, under all conditions of track, since the limit of practicable acceleration on clean rails is usually taken as being in the neighborhood of 2 miles per hour per second. The chances are that the acceleration under similar conditions is about the same in all the large cities of the country, and that it is very near the limit that can be depended upon under all conditions of weather.

Coming now to the second part of the proposition, that the motormen have the "indolent" habit of shuting off the current some

time before the brakes are applied in order to save work at the brakes. The report, if based on facts, would indicate a remarkably high state of efficiency on the part of the motormen in that particular city. Indeed, it is just by this shutting off of current and letting the car drift that the greatest saving in energy required to propel a car in street railway service can be made. The difficulty has always been to get a careless or indifferent motorman to do this. The making of a faster schedule speed is sometimes of more consequence than a small saving in electrical energy. Under ordinary operating conditions the energy required when current is kept in the motors up to the point of applying the brakes is all out of proportion to the gain in schedule speed obtained by this practice, as compared to that of letting the car drift as much as possible. In ordinary city service when the car is on time, it should be possible to allow it to drift with current off a considerable portion of the time after it has attained full speed until it is time to apply the brakes. This, then, leaves a margin upon which time lost can be made up by keeping the current in the motors up to the point of applying the brakes before each stop. If it were possible to maintain schedule time over a given street railway line, only by always accelerating as quickly as possible, and keeping the current on the motors up to the last instant before applying the brakes, electric traction would be as helpless as was the old cable system in making up lost time, or in maintaining regular schedule on rush-hour trips. Fortunately, however, it is not only possible, but necessary, to arrange the schedules so that ordinarily schedule time can be made without making use of every artifice to gain time, and this leaves room for considerable drifting, if the motorman is disposed to do so, as long as the car is on time, while, if at any time it gets behind, the expedient of keeping current in the motors every second possible is resorted to to make it up.

Electric Railway Development

There are many points in connection with electric railways that we are apt to touch upon and emphasize so often that to us and our readers they have long since become truisms. We are always glad, therefore, when other organs of public opinion take up the same subjects, and, by viewing them from their own standpoints, approve the sentiments entertained within the industry, and impart freshness by new and different considerations pertinent to the topic. It is natural that the wonderful growth of the electric railway should attract newspaper attention, and it is altogether gratifying to note that the foul and vile abuse of it from the press that was so common some ten years ago should have turned into pæans of enthusiastic praise. The fight then was a hard one, and we recall the remark of one man well known in the electrical field, who, when asked why he did not take up and push the trolley system, said very energetically that he "was not a Christ to be crucified." Times have changed, and while the innovator will continue to meet scorn and obloquy, it may be safely said for the electrical railway that it has arrived—pace the New York Central.

The journals of technical basis have naturally been more favorable from the first toward the use of electromechanical traction, and with them those which reflect the views of the commercial community. An evidence of the appreciation of what electric traction is doing is shown by an elaborate review last week in the New York *Commercial* of the development of the electric railway during the last fifteen years, and once more, as we have done before, it is shown how the trolley road has helped communities, benefited the farmer, built up new regions, created prosperous suburbs, and afforded to capital and labor a splendid arena for their profitable employment. Using our well-known annual statistics the *Commercial* points out how enormous has been the extension of the industry, and how well it also compares in this respect with steam railroad work for the same period, and even in its fifteen years, as compared with the seventy of steam. Such articles as this, intelligently prepared and impartially written, assist to a better comprehension of what electricity is doing, and they are calculated to do good over a wide range of minds open to information and instruction.

Removal of Snow from Tracks

The rule was stated many years ago that a vehicle has equal rights with a horse car in the streets of city. This proposition applies to street railways although propelled by the more modern methods of cable or electricity. This rule is to be viewed only as a general one and is subject to minor exceptions. In one sense, for example, a street railway company has a paramount right, in that a vehicle, proceeding at a slow pace upon the trackway, should turn out within a reasonable time and allow a street car behind it to pass. Again, street railway companies are not under obligation to observe the ordinary law of the road, because they must follow their rigid roadbed and cannot turn out to avoid other vehicles.

In the main, however, the rule as to equality of rights in the street holds good. It is illustrated, on the one hand, by the fact that a person attempting to cross a city street railway track—unlike one approaching the track of a steam railroad—is not absolutely guilty of contributory negligence if he fail to look and listen, but that the negligence and freedom from negligence of the respective parties will be determined by the circumstances of the particular case. The rule is exemplified, on the other hand, by decisions of the courts that a person driving on a street railway track is not entitled absolutely to rely upon a warning to be given of the approach of a car behind. While it is the duty of a motorman to give timely warning if he sees a vehicle ahead of him, and to exercise reasonable care to discover a vehicle in season to give the warning, he is not rigidly bound to do so under all circumstances. If a rear-end collision occur, the obligations and liabilities of the parties will be judged by the specal facts appearing.

The general rule of equality of rights in a street has recently been applied by the Supreme Court of Wisconsin, in the case of Gerrard vs. La Crosse City Railway Company (February, 1902, 89 N. W., 125). The plaintiff while driving in a cutter was tipped out and injured through its overturning, and the court decided that the defendant railroad company might be held liable for the damage suffered, because in the removal of snow it had left a declivity at the side of its track which rendered the street unsafe for public travel. The law of the case was expressed as follows, in the opinion:

> Even in the absence of any requirements in the ordinance upon the subject, it must be held that when the defendant company received its franchise to operate a street railway upon the streets for its private gain, as well as the public convenience, it at the same time assumed a duty to the public not to unnecessarily render ordinary travel on the streets dangerous. It must exercise its rights with due deference to the rights of the general public. It has no license to build and operate its tracks with total disregard of the rights and safety of the man with the horse and wagon, or the woman with the horse and cutter. On this subject, the Messrs. Elliott, in their work on Roads and Streets (second ed., sec. 764), say very aptly: "A street railway company which accepts a grant or a license impliedly agrees that it will use due care not to unnecessarily impede travel or to make the use of the street hazardous. The burden which it assumes in conjunction with the benefit which it obtains is a continuing one, and it must bear it, though to do what due care and diligence requires may sometimes entail considerable expense. * * * Where the track is cleared for its own convenience, it must do what is reasonably necessary to make the part of the street not occupied by its tracks reasonably safe, for it cannot for its own accommodation obstruct it so as to endanger travelers." We accept these propositions as correctly stating the law. It is said that to require the company to remove any part of the snow from the street outside of its tracks is an undue burden, involving, perhaps, great labor and expense; but, as pointed out above, the company, by accepting its franchise, assumed a duty to the public, and any disposition which it is obliged to make of falling snow in order to run its cars must be such a disposition as preserves the rights of the public to have a reasonably safe street for ordinary travel. If the public right can be preserved by simply brushing the snow to one side, well and good; but if the snow is so deep that the right can only be preserved by removing the snow from its tracks and from such additional space outside thereof as is necessary to prevent the formation of a dangerous declivity, then the company must make such removal. Any disposition which it makes of the snow must be made with due deference to the rights of travel upon the highway.

In large cities systems now exist for the public removal of snow from the streets, including such portions as are occupied by railway tracks, but wherever a railway company is under obligation, or assumes to remove snow from its tracks, it will be well to keep in mind the duty and liability above explained.

The Private Branch Telephone Exchange of the Brooklyn Rapid Transit

In the operation of any large business nowadays, the private telephone exchange and desk telephones have become a necessary feature. Ordinarily, however, the branch lines from the private exchange are confined to a single building or group of buildings, so that the telephone operator is in a somewhat isolated position as regards the system operated from "central." In a large railway company, on the other hand, the various branches from the private exchange go to all parts of the city, and are often found to overlap the boundaries of the territories of several exchanges. This practically superimposes the service of the railway exchange upon

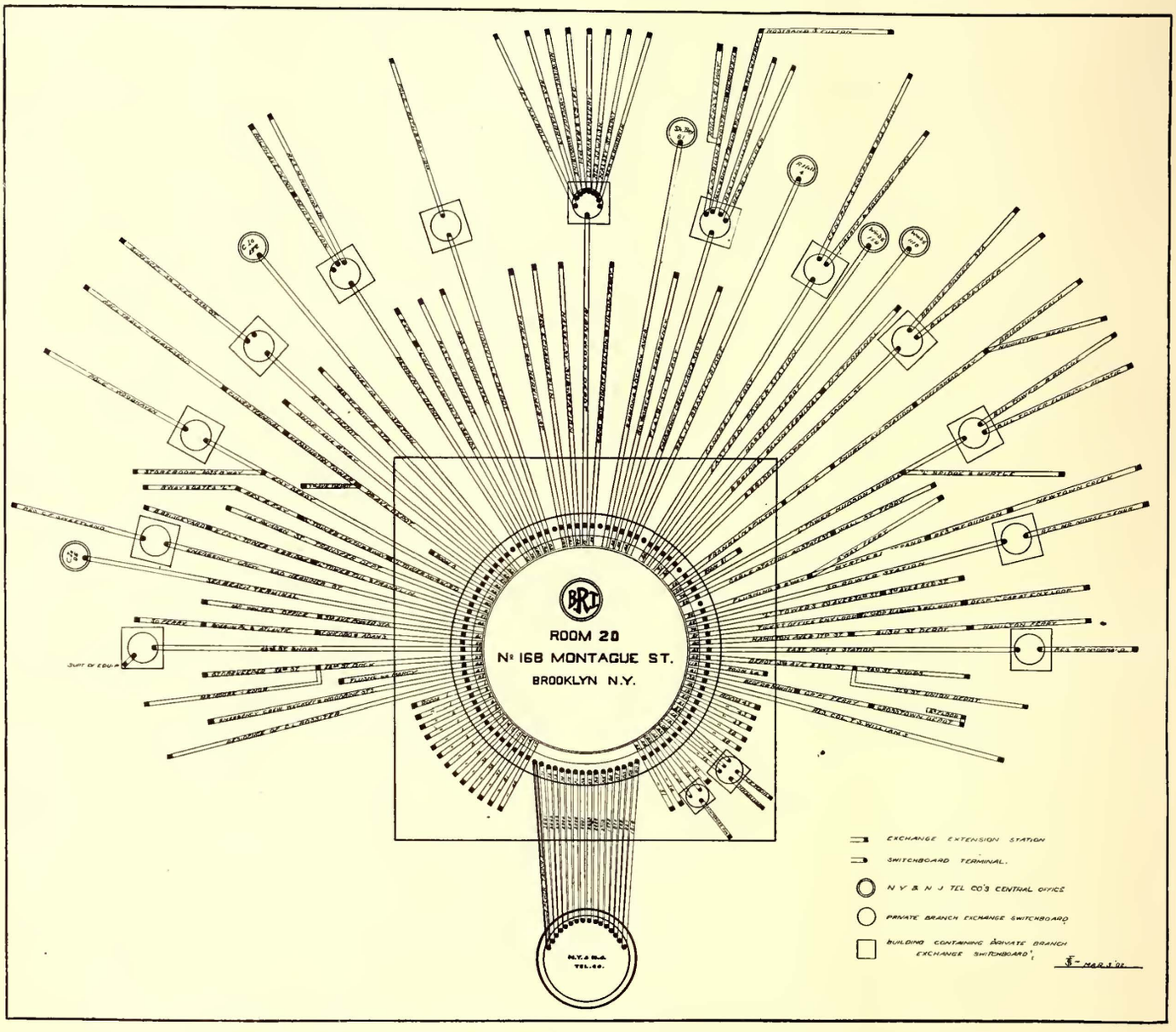


DIAGRAM OF PRIVATE TELEPHONE SERVICE OF THE BROOKLYN RAPID TRANSIT COMRANY

that of the city service, the lines frequently paralleling each other for long distances.

Probably the most complete system of private telephonic communication in existence has been established in the city of Brooklyn, and the accompanying diagram gives a general idea of the various connections found in this method of bringing together every office, shop, yard and power station of the Brooklyn Heights Railroad Company. The private exchange is located at the main office of the railway on Montague Street, and it is here only that special operators are required. A view of this exchange is given in the accompanying half-tone engraving. As will be seen, accommodation is required for two operators, and during the day they are kept busy making local and outside connections. At all times, day and night, there is at least one operator in attendance. A very complete system of bookkeeping has been inaugurated in this department for recording calls and showing the amount of business done.

The private branch exchange has at present 147 extension stations, of which 30 are in the building where it is located and the remainder distributed all over Brooklyn. There are only 83 jacks in the switchboard, a number of the lines having several instruments at their ends on an auxilary exchange or being used as party lines, but the work of the operator is, of course, practically the same as if it contained as many jacks as there are extension stations, or 147, as above. In general only calls involving the central station, both outgoing and incoming, are recorded, but a count of the local business was courteously made last week for the benefit of this paper. It showed, under ordinary conditions, a total of 900 local calls for a single day. The average outgoing and incoming calls are respectively 450 and 600, showing that the various departments call each other up twice as often as they call outside, and that three-fifths of the calls received by them are of the local type. These calls are, of course, much more numerous during times of trouble, such as fires, snowstorms, breakdowns, etc., but the greatest increase is almost invariably on the local calls. At such times the chief operator goes to the "supervising set" at the left of the switchboard and attends personally to all the trouble calls, many of which have to be taken down on paper and repeated on account of the lines being abnormally busy. The chief operator has complete charge of the bookkeeping of the department as well as a general superintendence of the system, two other operators being constantly employed at the switchboard during the day. Between the hours of seven and eight each morning every wire of the exchange is tested and all telephones which do not work properly are reported immediately to the New York & New Jersey Telephone Company, which makes all repairs to lines and instruments. One of the duties of the operators is to give the correct time to the power stations, car houses, etc. A self-winding clock is placed in the exchange room for this purpose,

giving standard time and controlled by the circuits of the Western Union Telegraph Company.

Although the common-battery telephone system is in use in Brooklyn the railway company's exchange has not yet been arranged for its use on the private lines. It is still operated, therefore, from battery cells in the basement of the building. The great length of the private branches would render it difficult to operate the system on the battery now installed at the telephone company's central. A special power trunk is provided to supply the Brooklyn Rapid Transit exchange with current for calling central.

One point of interest to be noted on the diagram, which

PRIVATE BRANCH EXCHANGE

is reproduced from a drawing recently made for the officers of the company, is the large number of wires running to the New York & New Jersey Telephone Company's central exchange. There are fifteen of these trunks, six being used for outgoing calls and nine for incoming, except in very rare cases when the ordinary balance is materially disturbed. It is very exceptional, for this reason, to find "the line busy" when telephonic communication is desired with the Brooklyn Rapid Transit. Some of the auxiliary exchanges in the outlying districts have as many branches as the ordinary private exchange and the extension stations on these may be used for intercommunication even when the line to Montague Street is busy. There are no regular attendants at these smaller exchanges, as they are placed in offices where there is always sure to be someone present to make the desired connection. Every telephone on the system can be connected to the Brooklyn exchange, and from there to the local city or long-distance lines.

The railway company rents its instruments and lines from the telephone company, a certain amount being paid each year for their use. There is no charge for local calls which do not use the trunk lines. Records are made on slips of all outside calls which are afterward summated and compared with the accounts of the telephone company. A complete check is also kept on all "foreign" or extra rate calls, and a daily statement rendered to the various departments. Private calls, where there is an extra charge are paid for by the individual making them.

Telephoning from Moving Cars

Some experiments were made recently by the Grand Rapids Street Railway Company in telephonic communication from cars in motion by means of an auxiliary wire placed parallel to the regular trolley wire and about 1 ft. distant. Connection was made by a special trolley pole and wheel carried on top of the car. About one-half mile of track was equipped with the system, and no difficulty was experienced in conversing, either between the cars or from one car, through the exchange in Grand Rapids with ordinary subscribers. The experimental line was erected by Benson Bidwell and Charles F. Bidwell, the inventors of the system used.

Competition of Steam vs. Electric Parallels *

BY C. H. DAVIS, M. Can. Soc. C. E.

In a recent discussion before the American Society of Civil Engineers the writer expressed the following conclusions as to the "Economic Electric Future of Railroads":

"(1) Steam railroads will, in the near future, handle their suburban and short-distance interurban passenger traffic and mail, express, baggage and light local freight carried in said suburban and interurban passenger trains, by electric motive power; and this irrespective of whether operating expenses are affected favorably or unfavorably.

"(2) Steam railroads will not, in the near future, handle their freight traffic (other than mail, express, baggage and light local freight carried in suburban and interurban passenger trains) and long-distance passenger traffic by any other motive power than steam locomotives.

"(3) Steam railroads may, under exceptional conditions of large volume and great density of passenger traffic over distances longer than under (1) and shorter than under (2), handle it by electric motive power, but such cases will be infrequent.

"(4) New railway lines, connecting very large centers of population, where frequent service at much higher speeds than can be attained now by steam locomotives on existing lines are conditions of success, will be operated by electric motors.

"There are three conditions under which suburban and short-distance interurban traffic will be handled profitably by steam railroads converting to electric traction:

"1. (a) Where units can be light and frequent, and operated over comparatively short distances.

"(b) Where gross receipts can be so increased by the change of system and mode of operation as to pay for the increased investment and possible increase in operating expenses.

"(c) Where competition of parallel electric roads compels the change, to save what traffic there is, irrespective of how operating expenses are affected.

"In the future development of steam railroad systems they will eventually be operated jointly with surface electric railways, either through actual mutual ownership or by traffic contracts, leases, etc.

"The above conclusions are obviously dependent upon what Mr. Prout properly defines as 'traffic conditions,' and not primarily engineering details or operating expenses."

In the discussion referred to it was shown that the first cost of an electrically equipped railway, under steam railroad conditions, would be greater than present locomotive lines, assuming both to be new; and in case of a change from steam to electricity there would be an additional investment equivalent to a greater first cost. It was also shown that the cost of operating was unlikely to be less with electricity, under existing steam railroad conditions, unless the number and frequency of the units approached that existing on our street railways. The inducement for a change of motive power must, therefore, come from possible increased revenue. Clean, light, airy cars, good roadbed neatly kept, fine stations and terminals, quick and frequent service, low total cost, etc., influence passenger traffic on any line; it is obvious, however, that one or the other motive power cannot affect this traffic *per se* except on the one score of cleanliness in favor of the electric motor (very dense traffic not considered with practicability of closer headway by use of motor trains).

The use of electric motive power enables giving to the public quick, frequent service at a lower operating cost and total cost for transportation than can be offered by the use of steam locomotives, and it is this quicker and more frequent service that will cause the enormous increase in passenger traffic, justifying the change whenever it properly takes place. This is apparent when we realize that existing trolley parallels have not so much taken traffic from the steam railroad as they have created a traffic which did not formerly exist; in fact, most such electrical parallels could not continue to exist if they were dependent upon this "captured!" traffic, although in some exceptional cases it has been considerable, and has seriously affected the steam railroad.

It is the object of this paper to show the existence of this "created" or "induced" traffic of electric roads due to their location and operative methods, which if properly applied to some existing steam railroads would produce the same, if not greater, results; and, furthermore, that it is this traffic, and not that taken away from the parallel steam road, which makes the "trolley parallel" a successful and useful enterprise; as much so to the steam road as to the community did the former more often utilize them.

* Paper read March 13 before the Canadian Society of Civil Engineers.

LAWS OF PASSENGER TRAFFIC

The laws of passenger movement are not well defined, and many of them are illusive and hard to determine; the causes of loss or gain are often largely a matter of individual judgment, so that the following outline of them must not be taken as in any way exact.

People travel from one place to another from (1), necessity, and (2), pleasure or whim.

They are induced to travel more or less often according to:

1. Total Cost from Point of Departure to Objective Point and Return to Place of Beginning.—As the total cost is reduced, travel, due to both fundamental causes, is increased; presumably less rapidly than the total cost falls. Note that the important factor to the passenger is total cost, and not cost per mile traveled.

2. Total Time Consumed in Making the Round Trip.—As the total time consumed is reduced, travel, due to both fundamental causes, is increased, presumably less rapidly than the total time falls. Velocity of transportation is not primarily effective in inducing travel, for it makes no difference to the passenger whether he be carried 80 miles in 30 minutes or only 12 miles.

3. Total Conveniences Afforded the Passenger.—These may be divided into:

(a) Proximity of departure and arrival points to possible passengers. As a "leave-at-your-door" service is approached, passenger traffic increases, but according to no known ratio to distance. Wellington laid down an approximate rule of loss of natural revenue for steam railroads of 10 per cent per mile of removal from center of population as a minimum, 25 per cent per mile as an ordinary maximum and a much larger percentage of loss, or even total loss, under certain conditions. Electric street railways have profited more by this kind of service which they offer the public than from any other reason; in furnishing it they give frequent and quick service, both of which are of the greatest importance in their effect on passenger traffic. Much less than a mile, however, will make or ruin the passenger traffic of a street railway.

(b) Frequency of the service. As the number of trips increases, so will the passengers, but less rapidly than the headway is shortened. A frequent service means less "total time" consumed.

(c) Character of terminals, stations, roadbed, equipment and, in fact, all physical characteristics. That transportation system which offers, at the same rate and time, better physical conditions, which gives comfort or even luxury to the passenger, will not only secure competitive traffic, but induce that which would not otherwise exist.

4. Total Population.—As the population served increases, the passenger trips per capita per annum increase, and somewhat faster than the inhabitants, unless modified by density and distribution.

5. Density.—As the density increases, it is probable that the rides per capita per annum also increase, but whether more or less rapidly is uncertain.

6. Distribution.—A long, narrow town will give more rides per capita per annum than a square town having the same population.

7. Character of Industries and Population.—The effect of various industries and the kind of population must have a decided effect on the passenger traffic, but probably according to no fixed laws, and certainly according to no known laws.

No "detailed defense" is offered to these laws other than what support they may obtain from other publications by the writer.

From the above we see that items (4), (5), (6) and (7) are independent of motive power or operative methods and therefore need not enter into our discussion.

Item (1) favors the "trolley" over steam because the location and mode of operating the former enables the delivery of transportation to the consumer at a much lower total cost per trip than can be done on our steam railroads.

Item (2) may favor one or the other system according to location and distance traveled; on comparative short hauls the "trolley" will be favored because of the "leave-at-your-door" and frequent service.

Item (3) (a) and (b) decidedly favor the "trolley" system, and these affect traffic more than any others except the total cost; (c) favors our steam railroads, but as compared to a "leave-at-your-door," frequent service, at low total cost, it has relatively but little effect on the traffic.

It is seen how most conditions favor the "trolley" road much more than the steam railroad, especially due to their peculiar location and operative methods.

EFFECT OF COMPETITION

One often hears of the competition which electric parallels have brought to our steam railroad systems. This has been exaggerated greatly, for most of the traffic of electric railways did not exist until created by low "total cost" and frequent and quick service, although, in certain isolated cases, the building of electric parallels has temporarily drawn away traffic from steam railroads, only to be recovered as the total volume naturally increased. This fluctuation and recovery in traffic, on parallels which changed motive powers, has been shown clearly in the building of elevated and street railways in New York City. The Third Avenue Elevated so decreased the traffic on the horse surface road as to cause alarm to the stockholders; the conversion of the horse railway to a cable road decreased the travel on the elevated, which was subsequently more than recovered.

Fig. 1 gives a good example of the decrease in traffic on the Manhattan Elevated Railway in New York City, operated by steam locomotives, due to the increase in speed and frequency of service on the Metropolitan Street Railway in its changes from horse traction to cable and electric. The loss on the elevated road from 1893 to 1897 was approximately 40,000,000 passengers—part of which was due to the financial depression throughout the United States, as indicated by the "dip" in all curves on Fig. 2; how much this amounts to it is impossible to determine and most difficult to estimate, but an approximation can be made from the retardation of increase shown in the curve on Fig. 2, giving passenger trips on all electric roads in Massachusetts. Projecting the curve by connecting 1893 with 1897, it would indicate a natural proportional in-

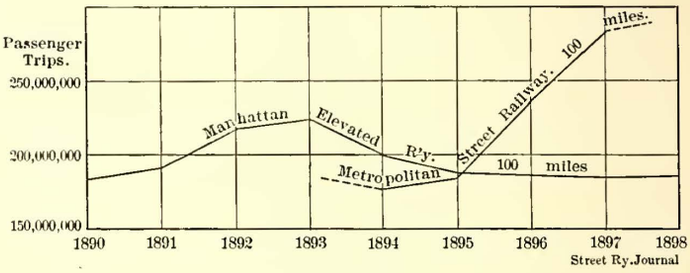


FIG. 1

crease in 1894 of 17,000,000 more passengers than actually took place, which represents approximately the retardation due to the financial depression, or about 7.7 per cent of the total traffic. If we assume the same loss from the same cause on the elevated railways, about 17,000,000 of the above 40,000,000 loss is accounted for by the industrial depression, leaving 23,000,000 loss due to competition. During the same period the Metropolitan Street Railway gained about 110,000,000 passengers, or nearly five times as many as the elevated roads lost. The mileage of both roads remained constant, or nearly so, as in the Metropolitan curve are included, for the years taken, all roads now owned or operated by this company. These years also cover the change in motive power of this system. This increase in traffic on the street railways of New York undoubtedly comes largely from increase in speed, better physical conditions, such as track, cars, lighting, heating, cleanliness, open cars, etc.

TABLE 1.—EFFECT OF COMPETING ELECTRIC INTERURBAN PARALLELS TO STEAM RAILROADS

Localities Connected	Loss Due to Trolley Parallels, as Claimed by N. Y., N. H. & H. R. R., before Railroad Committee, State Legislature of Connecticut (a)	Approximate Distance in Miles, from Railroad Commission Map	Trips per Day as Given by Time Table of N. Y., N. H. & H. R. R.	Trips per Day of Trolley Roads	Number of Passengers Carried by Electric Railway System in and between these Towns, Part of Which Traveled between Them (1894)
Norwalk—Rowayton	50%	4.75	27	84	956,241
Bridgeport—Stratford	$35 per day	3.00	36	84	4,659,322 (Est.)
Bridgeport—Southport	80%	5.50	23	63	
Waterbury—Naugatuck	90%	6.00	13	69	2,624,421
Wallingford—Meriden	30%	5.52	17	30	2,001,347
Birmingham—Ansonia	90%	3.00	16	112	1,033,977
Winnepauk—S. Norwalk	(b) 50%	3.00	--	--	1,090,263
	---	----	--	--	12,365,571

(a) Total loss to N. Y., N. H. & H. R. R. from all parallel trolley roads in the State of Connecticut = $4,000 per month = $48,000 per annum, or 1/8 of 1% loss on total passenger income of $12,971,000 in 1894, as shown by Railroad Commission Reports. (b) 64 passengers were carried on N. Y., N. H. & H. R. R. in the month of December 1893, and 9 in the same month of 1894, or a total loss of 780 passengers per annum, at a possible maximum of 15 cents = $117.

The elevated railways are operated under the same general conditions as exist on street railways, although the units are heavier, but they are very frequent; of course, they have the disadvantage of being confined to what might be called "trunk" lines without feeders. These frequent units are now operated by steam locomotives, but a change to electric motors is about to take place. This change is not warranted by any decrease in operating ex-

penses which will take place, either actual or sufficient, to offset the interest on the additional investment, although in the first years of electric operation figures will no doubt be produced which will appear to indicate such a result, as in two cases already cited. Nevertheless, the change, if made, will be a profitable one from the natural and induced increase in the traffic of the future, just as the large investments of our steam railroads in improved terminals, track, rolling stock and stations have been justified. Similar results will be the inducements for a change of operative methods on parts of our steam railroad systems, which change necessitates a change in motive power.

Table No. 1 has been prepared from a speech by Mr. Edwin B. Gager before the railroad committee of the State Legislature, at Hartford, Conn., March 22, 1895. For many years bitter warfare has been waged against interurban electric railways by the Consolidated System (New York, New Haven & Hartford Railroad Company), resulting in the electrical parallel law, where "public convenience and necessity" must be demonstrated to the satisfaction of the Superior Court before an electric railway can be built between two points already connected by a steam railroad. More unwise legislation against a natural progress, which would also benefit those whose influence created it, can scarcely be imagined. It is fair to assume that in this controversy—for the street railways naturally opposed such legislation—both sides produced the strongest arguments in support of their respective contentions; the Consolidated presenting losses of traffic, while the street railways insisted that their passenger travel was mostly an induced one which did not and could not exist under steam railroad conditions and operative methods.

An examination of Table No. 1 shows conclusively how the steam railroads convicted themselves. The Consolidated System only claimed a total loss of $4,000 per month, or $48,000 per annum on the entire system, being about 1-3 of 1 per cent of their gross passenger revenue. If the average fare were 10 cents, this would mean a total loss of 480,000 passengers per annum out of a total of 44,448,324, or 1.1 per cent; but 1894 was the year of financial depression, when the steam railroads of Massachusetts lost 8.2 per cent of their former passenger traffic, so that only part of this loss on the Consolidated was due to trolley parallels. While the total loss to the Consolidated was given by its officers, all the towns between which it occurred were not stated, so that in Table No. 1 the 12,365,571 passenger trips, between and in a few of these towns, is only part of the total passenger traffic of the street railways serving all localities where such loss took place. Whether this figure should be increased by 50 to 100 per cent or more we cannot say, but, in any case, the data are sufficient to show the large induced traffic of street railways; or, in other words, systems which give low fares, frequent service, short total time consumed in round trip and a "leave-at-your-door" service.

To emphasize the fact of what might be called a "dormant traffic" which can become an "induced traffic" under proper operative conditions, and to bring out this fact more clearly, Fig. 2 and Table No. 2 have been prepared, and these again show what a small part of the traffic of street railways has come from the losses of steam railroads, and, also, that a large part of this loss has been wrongly attributed to electric parallel competition.

The passenger traffic on steam railroads in Massachusetts has increased constantly from year to year since 1870, except during two periods, both of which coincide with industrial depressions; this is shown by Curve 1, Fig. 3, where the loss began in 1873 and 1893. Short-haul passenger traffic is but little affected by financial conditions when compared with the effect on long-haul traffic; this is due mainly to necessity being the basis of short-haul passenger business, or, in other words, it is composed mostly of commuters or suburban and interurban travel. Curve 2, Fig. 3, corroborates this position, for we see that the passenger trips on street railways (short-hauls, from necessity, as the controlling factors in volume of traffic on these systems) increased after 1874 and 1893, although less rapidly than in the year previous, but there was no actual decrease. This curve brings out another interesting fact, namely, the quicker recovery of electric roads and their more rapid increase in passenger traffic than when operated by horse-power,

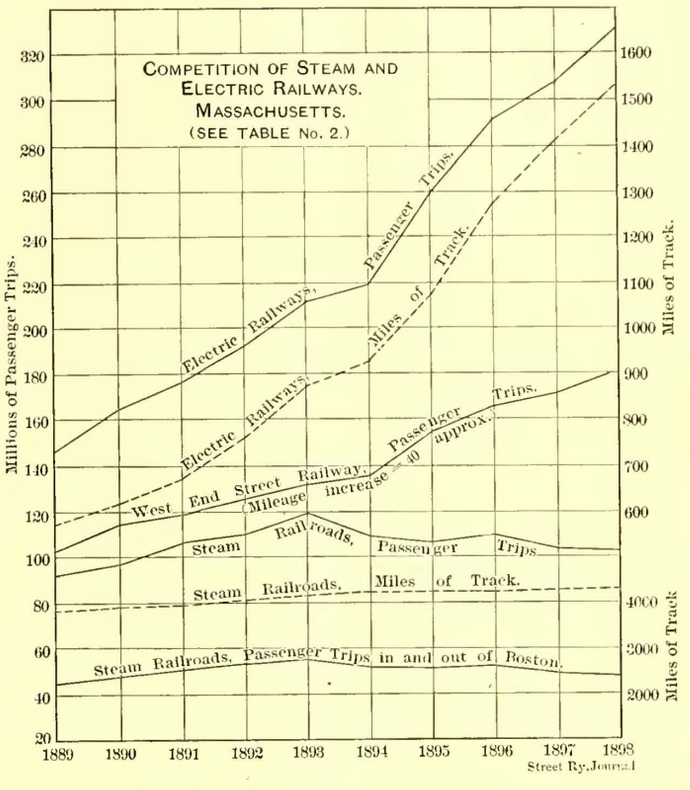


FIG. 2

again supporting our position. In Massachusetts electric railway mileage has increased along with the passenger traffic (1889 to 1898) 163 per cent in the former to 123 per cent in the latter, or, approximately, each has kept pace with the other. In other words, these railways have been built where traffic did not previously exist, nor could it be produced by the steam railroads under existing conditions; it has been "induced" by the character of the electric roads and their operative methods. Steam railroad mileage has only increased 10 per cent in Massachusetts during the same period, and passenger traffic 9.6 per cent (net).

TABLE NO. 2.—COMPARATIVE LOSS ON STEAM RAILROADS AND GAIN ON ELECTRIC RAILWAYS—MASSACHUSETTS—(SEE FIG. 2)

YEAR	Loss in Passenger Trips per Annum on all Steam Railroads in Massachusetts	Loss in Passenger Trips per Annum on Steam Railroads in and out of Boston.	Loss in Passenger Trips per Annum on Steam Railroads in Massachusetts, Omitting Those in and out of Boston. Column 2, Minus Column 3.	Gain in Passenger Trips per Annum on all Street Railways in Massachusetts	Amounts in Column 5 Divided by Those in Column 2	Gain in Passenger Trips per Annum on West End Street Railway System in and out of Boston	Amounts in Column 7 Divided by Those in Column 3
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1889 to 1893	26,250,648 Increase	11,406,434 Increase	14,844,214 Increase	67,362,606 Increase	2.4	29,620,468	2.6
1894	10,345,763	3,854,940	6,520,823	6,912,090	0.65	3,164,831	0.8
1895	1,577,836	740,680	837,156	39,330,209	24.9	18,203,057	24.5
1896 (Increase)							
1897	8,885,161	3,808,480	5,076,681	16,325,281	1.8	5,692,225	1.4
1898	803,168	723,748	79,420	22,205,405	27.6	8,766,782	12.1
	21,611,928	9,097,848	12,514,080				
1896 (Increase)	3,772,703	1,483,774	2,288,929	32,564,635	8.6	11,630,782	7.8
Net decrease 1894 to 1898	17,839,225	7,614,074	10,225,151	117,327,620	6.5	47,457,677	6.2

Turning to Table No. 2 and Fig. 2, we see that the net loss of passenger traffic on all the steam railroads of Massachusetts, from 1893 to 1898, was 17,839,225, but during the same years the street railways increased 117,327,620, or 6.5 times the loss of the steam railroads. If 7.7 per cent of the traffic was lost, due to financial conditions (as estimated heretofore), then only 8,600,00 passenger trips were lost to the steam roads of the State from trolley competition. If the average fare lost was 10 cents (when secured by the street railway the fare would be halved or even less for them), the total amounted to $860,000, or 2.4 per cent on the gross passenger earnings and 1.1 per cent on the gross earnings of the steam railroads; this would only amount to about 1 per cent of the total

net earnings. Again, the net loss to steam railroads in and out of Boston from 1893 to 1898 was 7,614,074, while the West End Street Railway (controlling practically all street railways in and out of Boston) increased 47,457,677, or 6.2 times the loss of the steam roads. Applying the same argument, only 3,225,000 passengers were lost by the steam roads in and out of Boston, due to

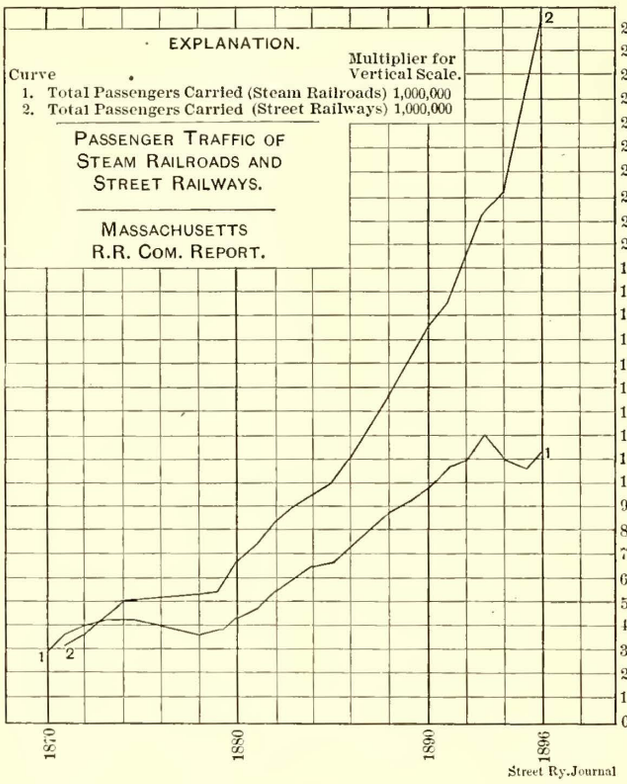


FIG 3

this competition. This would not be fair, however, for this traffic is made up more largely of commuters than long-haul passengers. Assume it at 5,000,000, which is undoubtedly too high, and with an average commutation rate of 7 cents, the loss is only $350,000 at the maximum. Furthermore, the greatest gains of the street railways throughout the State and the West End Street Railway alone were in 1895 and 1898, when the steam roads lost the least. All these data point to the conclusion, already stated, that competition does not take place to the extent usually believed; while an "induced" traffic is created by the low fares, frequent, quick and "leave-at-your-door" service, rendered possible by the physical characteristics and operative methods of the electric roads.

As an example of how a steam railroad could adopt the methods of the "trolleys," together with some natural advantages the former now have over the latter, we call attention to Ansonia, Derby and Birmingham, a center of 25,000 to 30,000 people situated about 10 miles to 12 miles from New Haven, Conn., with a population of 80,000 to 100,000. The New York, New Haven & Hartford Railroad connects the two centers which have their own local electric street railways; when the steam railroad owns the systems of street railways in both towns, their cars will pick up passengers at either center, will pass on to the present steam tracks on the right of way of the New Haven & Derby Railroad (New York, New Haven & Hartford Railroad Company), run at high speed without stops to the other center, pass on to the local street railway tracks there and distribute its passengers where they desire, all for one fare. Such a system operated by electric motors would be a financial success, where a line like the third-rail between Hartford and New Britain is a failure in the true sense. Many other similar examples might be given, but this indicates the future electrical development of our steam railroads to enable their benefiting from the enormous increase in traffic that is possible to "induce" by adopting the operative methods of our present "trolley" roads and approaching them in location, with the added advantage of their own right of way between centers of population where higher speeds can be maintained than is now possible on street railways.

It might be said, with apparent justice, that there are cases where a steam road has been seriously injured by an electric parallel and that these cases disprove our contention. There are, however, exceptions to every rule which "prove them." An examination of such cases will almost always lead to the conclusion that the steam railroad was disadvantageously, poorly, or even badly,

Table No. 3.—Statistics of the Philadelphia, Germantown & Chestnut Hill R. R. (Branch of Pennsylvania R. R.)

Year	Length of Road	Gross Receipts	Operating Expenses	Net Receipts Applicable to Taxes, Rentals, Interest, Dividends	Taxes and Other Expenses	Interest: On Bonds	Interest: On Floating Debt b	Total Charges Against Net Receipts from Operation (Cols. 6+7+8)	Net Receipts (Surplus or Deficit) Applicable to Dividends or Loss of Capital Stock (Differences between Cols. 5 and 9): Deficit	Net Receipts (Surplus or Deficit) Applicable to Dividends or Loss of Capital Stock (Differences between Cols. 5 and 9): Surplus	Cost of Road and Equipment	Par Value: Of Capital Stock Issued	Par Value: Of Mortgage Bonds Issued	Floating Debt	Total Par Value Securities Issued and Floating Debt (Cols. 12+14+15)	Per Cent: Operating Expenses to Gross Receipts	Per Cent: Net Earnings on Par Value of Securities Issued plus Floating Debt (Col. 5—Col. 6 / Col. 16)	Per Cent: Net Earnings on Par Value of Bonds Issued (Col. 9—Col. 6+Col. 8 / Col. 14)	Per Cent: Deficiency to be Made up to Meet Interest Charges on Par Value of Bonds Issued	Per Cent: Net Earnings on Par Value of Capital Stock after Paying Interest Charges on Bonds Issued and on Floating Debt (Col. 5—Col. 9 / Col. 13)
(1)	(2)	($ (3)	($ (4)	($ (5)	($ (6)	($ (7)	($ (8)	($ (9)	($ (10)	($ (11)	($ (2)	($ (13)	($ (14)	($ (15)	($ (16)	% (17)	% (18)	% (19)	% (20)	% (21)
1884	Miles 6.75	-----	-----	-----	-----	45,000	-----	-----	-----	-----	2,000,000	1,000,000	1,000,000	-----	2,000,000	----	----	----	----	----
1885	6.75	-----	-----	-----	-----	45,000	-----	-----	-----	-----	2,000,000	1,000,000	1,000,000	-----	2,000,000	----	----	----	----	----
1886	6.75	170,421	130,425	39,996	a 8,000	45,000	-----	53,000	c 13,004	-----	2,000,000	1,000,000	1,000,000	-----	2,000,000	76	1.59	3.30	1.30	----
1887	6.75	198,564	145,745	52,819	7,987	45,000	12,465	65,452	12,633	-----	2,000,000	1,000,000	1,000,000	249,300	2,249,300	73	1.99	1.23	3.27	----
1888	6.75	-----	-----	-----	8,332	45,000	4,590	57,922	-----	-----	2,000,000	1,000,000	1,000,000	91,800	2,091,800	----	----	----	----	----
1889	6.75	-----	-----	-----	7,947	45,000	2,465	55,412	-----	-----	2,000,000	1,000,000	1,000,000	49,300	2,049,300	----	----	----	----	----
1890	6.75	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----	----
1891	6.75	248,754	162,417	86,337	6,750	45,000	2,018	53,768	-----	32,569	2,036,060	1,000,000	1,000,000	40,360	2,040,360	65	3.90	4.50	----	3.25
1892	7.06	264,727	172,636	92,091	6,898	45,000	20,700	72,598	-----	19,493	2,414,894	1,000,000	1,000,000	414,000	2,414,000	65	3.52	4.50	----	1.94
1893	6.87	259,038	159,238	99,800	10,636	45,000	25,000	80,636	-----	19,164	2,500,895	1,000,000	1,000,000	500,000	2,500,000	61	3.56	4.50	----	1.91
1894	6.75	249,567	165,203	84,364	33,609	56,895	-----	90,444	6,080	-----	2,527,697	1,263,000	1,263,000	-----	2,526,000	66	2.01	4.02	0.48	----
1895	6.87	164,367	143,031	21,236	15,253	56,895	-----	72,088	50,852	-----	2,528,751	1,263,000	1,263,000	-----	2,526,000	87	0.24	0.47	4.03	----
1896	13.87	164,771	138,796	25,975	11,191	56,835	1,265	69,291	43,316	-----	2,528,751	1,263,000	1,263,000	25,308	2,551,308	84	0.59	1.07	3.43	----
1897	13.87	148,668	132,497	16,171	11,602	56,835	4,337	72,774	56,603	-----	2,528,751	1,263,000	1,263,000	86,754	2,612,754	89	0.17	0.02	4.48	----
1898	13.87	153,418	138,818	14,600	11,064	56,835	0,936	74,835	60,235	-----	2,528,751	1,263,000	1,263,000	138,723	2,664,723	90	0.13	(d)	4.50	----

a Assumed. b Estimated to be at 5 per cent per annum. c Derived from the assumed amount a. d Not only no earnings applicable to charges on bonds, but a deficit of $3,400 in any annuity to meet interest on unfunded debt

located for local traffic, and naturally would not prove profitable until such time had elapsed as enabled developing and populating the region immediately contiguous to the line. Under such circumstances a "trolley parallel" which was located more nearly along the natural artery of travel would seriously cripple the steam road although it might be just emerging from barren years to those of greater fruit.

An example of the effect of a "trolley parallel" upon such a road is shown in Table No. 3 and Fig. 4; they speak for themselves. While the gross receipts given in Table No. 3 and Fig. 4 include all receipts (passenger, freight, express, mails, etc.), the effect of trolley competition is nevertheless distinctly and relatively shown, for the trolleys carried nothing but passengers, so that the loss of freight, express, mails, etc., must have been very slight losses to the steam road. The horse railways from Philadelphia to Germantown, Pa., were electrified during 1895-96. It is believed the future will undoubtedly bear out the position taken in this paper.

(Note.—This article was prepared early in 1899; data for that year and 1900 now just at hand confirm the various judgments above expressed.)

The Portsmouth-Rye Beach Electric Railway *

BY G. M. TOMPSON

In the fall of 1897 the Boston & Maine Railroad decided, after acquiring the charter of the Portsmouth (N. H.) Horse Railroad, to construct a single-track system of street railway to be electrically operated by overhead trolley in the city of Portsmouth, and in the towns of Rye and North Hampton, N. H. The old city of Portsmouth is situated near the mouth of the Pisquataqua River, and the district served is one of the most beautiful summer resorts of the New England Coast, combining all the advantages of ocean and country attractions. Well-appointed hotels and cottages line the coast, and the drives into the interior are unsurpassed for good roads and beauty of scenery. These attractions cause a large influx of visitors each summer. The farmers of the locality are well-to-do, as the neat buildings and thoroughly cultivated fields attest.

The people of this section had no means of reaching the city of Portsmouth, their market, except by teams, and for this reason the summer business was not developed to its highest point. Portsmouth is but one and one-half hours from Boston by the Eastern Division of the Boston & Maine Railroad, while the Portsmouth & Dover Railroad, the Concord and Conway Divisions of the same system, all have their termini there.

It was believed that if rapid and comfortable transportation was provided to connect Portsmouth with the ocean front, many more people would be attracted to the locality, and the result has proven this belief well founded. The line was laid out by G. M. Tompson, and the plans show the country lying between the steam railroad, 3 miles from the coast, and the ocean, with all highways, hotels, dwellings, etc. The company laid its plans with the view of serving the maximum possible population. In Portsmouth the streets are very narrow, and in most cases the track was located in the middle of the street, leaving just sufficient room for teams to pass on either side. Since the road has been put in service very little trouble has arisen from this fact. The track in the city was constructed of 90-lb. girder rail, with oak cross-ties and broken stone ballast, surfaced and rolled into macadam. The macadam surfacing small stone and granite dust were used, being well saturated, while rolling. The granite dust made a first-class binder, and time has shown it to be better than trap rock to prevent 'rutting' by heavy wagons on the outside of the rails. All sharp curves were double-guarded. Wharton & Pennsylvania Steel Company switches were used. The overhead system was span construction, iron poles being used in the compact portions of the city, the balance being of natural oak or chestnut. There were about 6 miles of this construction in the city. The highways between Portsmouth and North Hampton were narrow and crooked, with many bad grades. It was decided to get as good alignment and grade as possible. When the plans and profiles were completed, conference was had with the town officials to make arrangements with them for widening, straightening and changing grades of the highways. These officials co-operated heartily, and the improvements were agreed upon, with the result that the track was located on the side of the highway, and in all cases more room was given to the public than they had before the road was constructed, and the line had a maximum of straight line with easy curves and grades. The expense of these improvements was mostly borne by the company, and general satisfaction is expressed by the citizens of Portsmouth, Rye and North Hampton over the new line.

On the highways the track construction was of 30-ft. and 60-ft. 60-lb. T-rail, with continuous and Weber rail-joints, double bonding oak cross-ties, and gravel ballast. The ballast was 18 ins. thick and of superior quality. Much attention was given to drainage. The highway was sloped from the track with a slight pitch to the opposite side. Two pile trestle bridges, each 500 ft. long, were constructed of oak piles, hard-pine stringers and ties, with guard ties and guard rails. Shelter stations were placed at crossroads. Telephones were placed at termini and turnouts, and the road is operated throughout by a train despatcher.

At highway crossings hot tar concrete was used in place of planking. Oak and chestnut poles and Croghead flexible brackets were used in the construction of the overhead system. The central power station is located on tidewater in Portsmouth, with a storage battery at Rye Centre, 7 miles distant.

The battery is composed of 264 "G-21" cells, and was installed by the Electric Battery Company, of Philadelphia. Its capacity is 800 amps., or the low rate at 550 volts. The battery feeds beyond Rye Centre during the day, and at night, when the Portsmouth plant is shut down, it feeds back toward the city. It is operated through a shunt booster in the power station, and is controlled through a two-panel switchboard at Rye Centre, which is equipped with a recording wattmeter, circuit breakers, switches, etc. No attendance is required in the battery house, but an electric bell circuit runs to the postmaster's house in connection with the circuit breaker. This official attends to the readings of acid, specific gravity, voltage and watt-hours input and output. One panel is used for feeders, the other for the battery, and the plant is well equipped with supplies, tools, lead-burning outfit, etc.

Power is transmitted by aluminum and copper feeders. The permanent way was brought as near steam-road construction as possible.

In closing, Mr. Tompson stated his belief that both steam and electric roads have their particular fields of usefulness. In many cases the electric road stimulates the steam road's traffic by feeding its trunk line. He stated that between points far apart, with long-interval train service, the steam road was preferable, but for local service from town to town, with frequent cars stopping on signal, with low fares and easier accessibility, the honors lay with the electric road, which gives better service than a few high-speed trains with long distances between stops. To give good local and express service with an electrically operated trunk line at least four tracks are necessary, especially when freight handling is considered. The advantage of lower original electric railway first cost is a powerful argument with the investor who compares electric and steam roads with a view to building.

Mr. Tompson also believed that signals for high-speed electric service are at present inadequate, and gave as his opinion that both the steam locomotive and the electric motor will increase their usefulness, each in its particular field.

* Abstract of lecture given before the Massachusetts Street Railway Association.

Controversy in Newton, Mass.

The controversy between the Waltham Street Railway Company and the Newton Street Railway Company, which was recently mentioned in these columns, has reached a stage where the petition for a franchise has appeared in the Waltham Board of Aldermen for the fourth time. Three times already the Aldermen have granted the Waltham Company's petition, and three times the Railroad Commissioners of Massachusetts have refused to approve the location as granted. Both companies are petitioning for the right to lay tracks and operate cars in Main Street. The contest was begun in 1900, when both companies were independent. The charter of the Waltham Company has expired, and it is doubtful if it can prove any legal status, although it is said to have spent $100,000 in Waltham and never operated a car. The Newton Company has been absorbed by the Boston & Suburban Electric Company. The Aldermen voted to lay the petitions of the two companies on the table until such time as both may be taken up together, pending the action of the Massachusetts Legislature in renewing the Waltham Company's charter.

A special press despatch from Chicago, dated March 24, stated that General Counsel W. W. Gurley and President John M. Roach, of the Chicago Union Traction Company, had gone to New York to confer with New York interests in regard to the recent transfer decision affecting the Union Traction Company and the Consolidated Traction Company. The report also said that the entire Chicago traction situation would be gone over while Messrs. Roach and Gurley were in New York.

Electric Shocks

The subject of the physiological effect of electric shocks on the human body was considered at a meeting of the Institution of Electrical Engineers of Great Britain, held in London Feb. 27. Three papers were presented on this topic, viz., "Electric Shocks," by F. B. Aspinwall; "Electric Shock and Legislation Thereon," by Gen. C. E. Webber, past president, and "Electric Shocks at Five Hundred Volts," by A. P. Trotter.

Mr. Aspinwall considered the question of individual temperament and condition as affecting the susceptibility of persons to shock, and gave it as his own opinion that not only are different people differently affected, but the same person under different conditions does not feel the same sensations from the same shock. He first considered the effect of disease, and cited cases where persons suffering from kidney trouble proved abnormally sensitive to electric shock. This he attributed to the fact that the skin in removing impurities from the body had a lower resistance than normal. On the other hand, he believed that certain other diseases, as for instance weak intellect, might give a partial immunity from shock. A heavy perspiration in some cases might render a person less sensitive to the shock, if the perspiration acted as a shunt for the current. Again, he believed that a man when drunk is less liable to be fatally injured, and that sleep gives considerable immunity from shock. Several instances of both conditions were cited.

Mr. Aspinwall then considered the effect of the path of the current through the body, and referred to several cases where similar shocks were received on the right and left hand sides of the body, and in which those on the left-hand side proved much more serious than those on the right. The question of contact, however, he considered more important than any other fact, and entered this subject in considerable detail. He stated that he had made tests of the resistance of persons when holding a No. 20 B. W. G. copper wire between the finger and thumb of each hand, and afterward when these two wires were connected to two pennies held in the same way. With the pennies the resistance was 20,000 ohms lower owing to the better contact. With moist skin the contact was of course even better. He also believed that the moistness of the skin reduces the chance of burning, as it insures better contact. The effects of direct and alternating current were then considered. That of the former is to knock the victim down, while that of the latter seems to draw him closer together. The direct current, however, will break a fault down quicker, and this undoubtedly has some effect when a shock is received. On the other hand, more burning will take place with a direct current, and this he considered a protection as it increased the resistance unless carried to an extreme, when it might itself cause death. Below 600 volts, independent of the nature of the supply, the speaker considered that conditions must be abnormally favorable to cause death, and between 600 volts and 1000 volts the conditions must be favorable. The liability to fatal accident with higher voltages depended on the circumstances.

General Webber's paper discussed the number of accidents which had been caused by shocks and the legislation on the subject. The records from 1880 to 1890 were quoted to show that during this period only thirty-eight persons suffered death from electric shock, and of these only two occurred within a power station. General Webber thought the precautions required by law were too stringent.

Mr. Trotter's paper, which was confined to shocks of 500 volts, is printed below:

MR. TROTTER'S PAPER.

A good deal of misapprehension exists as to the circumstances under which shocks at 500 volts may be felt, or the conditions which may lead to serious consequences. The electric pressure of 500 volts has become well established as the standard for electric traction, but apparatus designed for this pressure can be arranged to take another 100 or 150 volts without appreciable alteration. Considerations of commercial standardization seem to set the limit for working at about 600 volts; and it is fortunate, from the point of view of safety, that no further extension of pressure under ordinary conditions is likely to be needed.

Since in a few cases shocks at 500 volts have been fatal, newspapers have not hesitated to argue from the particular to the general, and have assumed that all such shocks involve serious injury, if not death. For once they are in good company: the technical press and eminent practical electric traction engineers seem to have a horror of 500 volts. Such horror has its wholesome side, but ignorance brought face to face with imaginary horror may result in panic. Modern journalistic sensationalism has made the most of the accident which occurred in Liverpool in February, 1901, and such was the scare that months afterward, when a harmless necessary trolley wire fell on a tramcar, passengers, not only jumping to the conclusion that they were threatened with a hideous death, jumped to the ground and sustained serious injuries. Irresponsible correspondents have suggested in the newspapers that to fall on the electric rails of the Central London Railway is to be grilled alive; they knew no better. But when, during the inspection of the last extension of the City and South London Railway, I stood on the rails in wetted boots, and sat on the live conductor and slapped the running rails with my bare hands, engineers, electricians, railway employees and others who ought to know better were surprised, and spoiled the effect of my demonstration by suggesting that I was peculiarly insusceptible to shocks.

A pressure of 300 volts was used at first for electric traction, but when afterward it was taken up and developed by Americans, they settled by *experimenta in coporibus vilibus*, that a pressure of 500 was high enough for economy and not too high for safety. The chief object of this paper is to record a few experiments and to discuss the conditions under which shocks at 500 volts are devoid of danger.

The subject may be divided into three parts: (1) The physiological and electrical conditions; (2) the dangers connected with trolley wires; (3) The dangers of third rails of electrical railways.

Physiological and Electrical.—In dealing with the first part, I need but barely allude to physiological matters, but will refer first to the current, then to resistances, and lastly to pressure. The sensation may be a prick, a pleasant tingle, a hot burning or a convulsive shock. The sensation does not depend directly on the actual current, but on the current density. With 4 or 5 sq. ins. (30 sq. cms) of contact between dry metal and bare skin (for example, grasping a trolley wire), a steady continuous current of 1 or 2 milliamps. is hardly perceptible. From 3 to 8 milliamps. are easily supportable, above 10 milliamps. is painful, and above 35 milliamps. almost unendurable. A larger current than 20 milliamps. is seldom used for medical applications. Every electrical engineer is familiar with the sharp pricking shock given by a fine wire. In that case the current density is very high, but the current is so small that little else than the tactile nerve endings in the skin are stimulated. With larger currents and more surface muscular contractions are added to the tactile sensations, especially if the current is at all unsteady. The electrical phenomena of nerve and muscle have been studied by physiologists. They are rather complicated, and do not concern the general purpose of this paper.

Alternating currents seem to be about four or five times more painful, but the sensation is of a different character. I have no knowledge of the relative danger of alternating and of continuous currents, and no further reference will be made to alternate currents in this paper.

It is difficult to make any exact determination of the relation between current density and sensation. More than about 14 milliamps. of steady continuous current at the finger tip, making a poor contact of about 1-6 of a sq. in. (1 sq. cm) is unendurable, but 35 milliamps. from boot to boot, nearly the whole of the soles o fthe feet being in contact, is much less painful. Under prolonged shock the current increases, owing to a fall of resistance, but that does not concern accidental shocks.

Passing now to resistances, the resistance from finger tip to finger tip on dry metal and under 100 volts is about 20,000 ohms. It varies a little with the volts, decreasing at high pressures. Two coins nipped in the terminals of an Evershed ohmmeter serve very well for electrodes. This finger-tip resistance is of considerable importance in connection with accidental light contacts at high pressures. The resistance is almost all at the skin. The thin skin on the inside of the wrist is much more sensitive than that of the palm of the hand. The difference between the resistance from finger to finger of one hand and between one finger of each hand is inappreciable. The resistance from hand to hand when grasping two pieces of dry trolley wire is about 5000 ohms; different individuals vary a good deal, probably owing to the dryness of the skin; I have found it as high as 14,000 ohms. The resistance between the body and the earth or an iron rail through the sole of the foot, stocking and boot is of considerable importance in connection with electric railways. I find that the resistance from boot to boot, the boots being dry and without nails, varies from 45,000 ohms to more than 200,000 ohms. The lowest of measurements on twenty-five different persons made with 500 volts gave 25,000 ohms. Boots worn into holes and wetted by walking on wet pavement gave only 13,000 ohms. The values for resistance of the human body given in medical works are of little use for the present purpose, for care is taken as a rule to facilitate the passage of the current. "Under conditions of medical practice, and using moistened electrodes, the resistance of the body, when the skin is well wetted with warm water, is about 2000 ohms or 3000 ohms, that is to say, an electromotive force of 12 volts (eight Leclanché

cells) will pass a current of 4 to 6 milliamps." ("Medical Electricity," Lewis Jones, p. 194.) Most of the measurements of resistance which I have given were made with 100 to 500 volts, and are calculated from the milliamperes which passed. Taking the information which I have already given about the effect produced by various currents, it follows that the mere touching of dry metal at 100 volts, finger to finger, gives hardly any sensation, but with a larger contact a shock is felt. At 200 volts a light touch gives an unpleasant prick, but the current through a firm contact is about 12 to 18 milliamperes, which most people can bear without considerable pain, especially if the contact be gradually made and broken. There is no after effect; the sensation is very similar to that of heat.

To grasp, with bare hands, two pieces of metal at 500 volts would give a very painful shock, but a light and quick touch is no worse than the shock from a half-pint Leyden jar, an experience more familiar to schoolboys than to engineers. A 500-volt shock may be described as worse than touching a kettle of boiling water, not so bad as touching a red-hot poker, about the same as touching a soldering iron at working heat, or as when an inexperienced blacksmith's boy picks up a black-hot horseshoe. These shocks are common incidents in the daily work of a carcless lineman; nearly all those who are practically engaged in electric traction work receive more shocks than they like, but they agree that they might reduce the number by taking more care. This is an important measure of the severity of such shocks, and perhaps the only one which will be appreciated by those members of the public who do not care to try for themselves. In such brief shocks the muscular sensations probably mask the contact sensations, but a bad 500-volt shock burns the skin.

Cases of fatal accident from 500 volts are so rare that the conditions can only be guessed at. If the skin resistance be reduced by moisture, especially if salt or chemicals be present, and if the contact be large and prolonged, 100 volts may be fatal. While repairing an arc lamp in a steam washing factory at Bradford, in 1899, a man is said to have been killed by a shock at 225 volts; a fatal accident occurred in Germany with about 300 volts, but a man may be choked by a crust of bread under exceptional conditions. The death of a man by blood poisoning arising from a burn caused by a short-circuit on the Central London Railway in December, 1900, does not concern us; a death occurred on the Metropolitan Railway in Paris, when a platelayer fell and remained fallen on the third rail of 500 volts, but the case to which so much attention has been drawn, and which has caused such a scare, is the accident in Pembroke Place, Liverpool. Instead of the present system of well-earthed guard wires, an attempt was made to keep fallen telegraph wires from touching the trolley wire, and the attempt was unsuccessful. Nearly fifty wires fell in a tangle across the street and lay on the trolley wire, which did not break. The passers-by in the street upon whom they fell escaped with a few shocks. It was dark and snowing, and a salted slush lay on the street. Two men walked blindly into the wires and were entangled, and, struggling, became entangled the more. The current was not cut off for nearly half an hour. Here was a lamentable combination of seven circumstances: (1) The unusual conditions of weather, the snow freezing to the wires as it fell. (2) Failure of the wood strip (which is still extensively used on the Continent) to act as a guard. (3) The large number of wires, the long span (375 ft.) and the tangle in which they fell. (4) The salt slush of snow in the street. (5) The darkness and invisibility of the wires. (6) Failure of the police telephone signal service. (7) The delay of 25 or 30 minutes before the current was cut off. If any one of these seven causes had been absent it is probable that the fatal results would not have occurred. It is practically impossible that such an accident can occur again in Liverpool, for the telephone wires which crossed the tramways have been either diverted, placed underground, or cabled at a great expense to the Corporation, and a considerable number of the Postal Telegraph wires have been satisfactorily altered. I am tempted to digress into the question of guard wiring, but this paper must be confined to shocks, and I hope that the discussion will be similarly restricted.

Dangers Connected with Trolley Wires.—Neither the man in the street nor a man on a car runs any risk of taking 500 volts skin to metal. On several occasions during inspections of tramways, when a trolley wire has been within reach from the top of a car, I have grasped it with both hands, and with more or less difficulty I have persuaded others to do the same. In each case the weather was fine, the car dry, and no shock, not even the least sensation, was perceptible. To show that there was no trick I have grasped the hand rail and flicked the trolley wire with a finger; the shock is trifling. It follows, therefore, that if a live trolley wire fall on a crowded car, although it may give alarming flashes when it touches a hand rail, or tramway rail, the chances of a shock on a fairly dry day are nothing compared to the obvious mechanical injuries which might be occasioned. Trolley wires do fall, and trolley wires are very properly excluded from the leading cities of the world—London, Paris, Vienna, New York, Buda Pest, etc., but as yet the damage done by the falls has not been electrical. A trolley wire is an obvious thing; it sometimes springs back in large coils, but it generally falls and lies still or hangs, and is regarded with a prudent solicitude which this paper is not intended to remove. But on a dry or frosty day anyone with tolerably good boots may fearlessly touch the live end even if he stand on the rail. I would not publish this statement had I not tried the experiment on some dozen persons, the majority being women and children. My son, seven and one-half years old, stood on a rail and played with wires, there being 500 volts between rail and wires. The current was less than ¼ milliamp., and he felt nothing. His boots were new. A fallen telephone wire is not so obvious; it does not stop the traffic; it is apt to writhe and to coil round a person. Should he fall on the rails the short-circuit might severely burn him. With wet boots and ground the conditions are different. Standing on damp granite setts in rather damp boots, and grasping a trolley wire, I found the current was 15 milliamps.; the sensation was by no means unendurable; brief touches gave sharp pricks. Standing on a rail increased the current to 20 milliamps. With old boots worn into holes, and after walking a couple of miles on wet pavement, standing on a rail and grasping a trolley wire gave 35 milliamps. I took this for several seconds, and I should be sorry to take more. I broke contact cautiously by raising the boot on one edge. There was no after affect; the sensation was merely that of heat, as though the trolley wire were hot. Spilling half a bucketful of water on the ground increased the shock intolerably. I am inclined to attribute this to the better contact between boot and earth rather than to decreased resistance of the earth (in this case granite setts). Three others tried the experiments with me, and as far as we are able to compare experiences I am satisfied that I am not relatively insusceptible to shocks.

Besides the fall of trolley wires, either on a car or in the street, there are roundabout and unlikely ways in which shocks may be conveyed to unsuspecting persons. For example, a lineman on a ladder, and somehow making a good earth, holding a wire while its broken end or a careless sag touches a trolley wire; but the discussion of such accidents belongs to the subject of guard wires.

Dangers Connected with Third Rails.—The first time I stepped on the live rail of a third-rail railway I clutched the engineer lest my legs should give way under the shock; but I felt nothing. I went to where some water stood half an inch deep on a cement floor, and "marked time" for two and a half minutes. With caution I stepped on the live rail and then on one of the running rails, felt nothing, stooped down and touched the running rail while standing with both feet on the running rail. I felt a slight tingle, which my subsequent experiments lead me to think was produced by a current of about 6 milliamps. To sit on the live rail without touching the running rails was easy, and I cautiously flicked the running rail, then touched it, and then laid my hands flat on it without the slightest sensation. In the light of the figures I have given this is not at all surprising, and I have invited several others to try the experiment, with the same negative result. Of course the result depends on the dryness of the clothes. The resistance of dry cloth is very high. After walking in the wet for about an hour with sound but not thick shoes I stepped on 500-volt rails and felt nothing, but on touching with the finger I received a smart shock, perhaps 30 milliamps. I have already stated that with old worn-out wet boots the resistance was only 13,000 ohms. This was found with only 400 volts. Standing on rails in my laboratory, the rails being connected to the outers of the Westminster Company, I could just support the current of about 30 milliamps. The sensation was almost precisely like standing on hot steam pipes. It was easy to turn it on gradually by beginning and ending with the edge of the sole. The shock would of course be very alarming to anyone who was not expecting it. There was no perceptible after effect. Ordinary nails in the heels of boots make no difference, but hob-nails give uncertain pricking stings which are rather painful, but under no circumstances need they be sustained.

Until I tried these experiments I must confess that I did not enjoy the walks which I have some times taken in "tube" railways during inspections by the light of oil lanterns, but now, with dry boots, I take no care whatever. It is very desirable that the live rails of third-rail railways should be guarded by planks to prevent short-circuits by tools, etc., and to make it less easy for a person falling on the rails to make contact with bare skin. While experience has shown that a person so falling may receive a serious and even fatal shock, this can only occur if he make contact with

both a live rail and a running rail with bare skin or thoroughly wetted clothes, and if he lie there for a time. As to the length of this time we know nothing, but so long as the fall has not injured the person, so that he cannot rise, it is very improbable that the shock would be maintained. A platelayer in the open yard of the Waterloo and City Railway once accidentally sat on the third rail, and made the circuit through his feet on wet ground; he shouted, and was pulled off by his mates. The contraction of the muscles prevented him from rising. He could probably have rolled over and so released himself. He was back at work again in a few minutes.

Numerous accidents to horses show conclusively that these animals are peculiarly susceptible to electric shocks. Electrical conditions under which a human being would receive an unpleasant shock of 10 to 15 milliamps. cause instant death to a horse, and it appears that horses are terrified under conditions where a human being would feel no shock. But it must not be concluded that a given current produces more effect on a horse than on a man. A horse makes excellent contact with its shoes, and these are well connected by nails to its body. It is probable that the resistance is very small and the current very large; but even making this allowance the horse appears to be more susceptible.

Conclusion.

The dangers of electric shocks at 500 volts have been much misunderstood, greatly exaggerated, and little investigated. The pressure of 500 volts has been deliberately chosen by electrical engineers because it is not dangerous under ordinary conditions. The conditions under which serious shocks are not produced by 500 volts are discussed in the paper, and it is safe to assume that all shocks more serious than those which are recorded are dangerous.

Dry wood and dry boots without large nails offer so great resistance to electric current that it is perfectly safe to touch a trolley wire while standing on a dry tramcar, or even while standing on the ground, or on the rails. Wet weather makes a considerable difference, but boots must be very wet to allow enough current to pass to produce a severe shock.

Men engaged in electric traction work receive many slight electric shocks at 500 volts, and they might avoid most of them by taking more care. Dry clothing offers so great a resistance that no shock can be transmitted through it. The peculiar conditions under which shocks at 500 volts have caused death are discussed, and are shown to be very exceptional.

Experiments have been made on some thirty persons, including twelve women and six children, and it is proposed to make other experiments.

With sound dry boots hardly anybody can feel a shock when standing on the live rail of an electric railway with one foot and a running rail with the other. With damp or wet boots a shock is felt, but neither the sensation nor the degree of wetness of the boots can be measured accurately. It is not possible to receive a shock by sitting or lying on a live rail so long as the clothes are dry and continuous—that is to say, so long as the live metal is not touched by the bare skin.

Proposed Street Railway Tax in Minnesota

Auditor J. F. Calderwood, of the Twin City Rapid Transit Company, of Minneapolis, recently addressed the Senate committee of the whole of the Minneapolis Legislature on the proposed Jacobsen bill. This proposes to tax the tangible real and personal property of the railway companies, and also its franchise, on the basis of the sum of the values of the capital stock and bonded debt, less the real and personal property. The bill says: "The residue shall be used as the basis for ascertaining the value of the franchise," and "the amount so ascertained shall be deemed the value of the franchise, which shall be subject to taxation in that amount as such."

Mr. Calderwood points out that at 30 mills on a dollar, the tax levy in the Twin Cities, the tax would be $962,922.56, or over 30 per cent of the gross earnings of the company for the calendar year just closed.

The plan for the construction of an electric underground railway between Gair Montfarnasse and the Butte-Montmartre, Paris, has been adopted by the municipality, and MM. Berlier et Jaincot have been granted the concession for constructing the line. They are to carry out the work at their own risk, subject to a royalty of one centime for every passenger carried. There will be fifteen stations along the line.

The Metropolitan Lease

The stockholders of the Metropolitan Street Railway Company, of New York, on March 20 voted to ratify the lease of that company to the Interurban Street Railway Company. The vote, as announced, was 405,174 shares in favor and 1,571 shares against. The much-talked-of opposition did not amount to much, although the meeting was marked by considerable animated discussion. At the final vote many of the opposition declined to vote on account of an exception taken to the ruling of the chairman, P. A. B. Widener, on a certain point. The real strength of those who were opposed to the lease, however, was shown on a previous vote to adjourn, at which a total of about 30,000 shares was recorded as opposed to the proposed lease.

The general plan of the proposed lease has already been published in the Street Railway Journal. The lease itself, which was made public at the meeting, is dated Feb. 14, 1902, and commences with a recital of the various properties owned by the Metropolitan Company, namely street railway lines and real estate, owned, leased and operated by the company. It also describes the property of the Interurban Company in Westchester County.

All the Metropolitan's property, with its franchises rights, powers, privileges, etc., is leased to the Interurban for a term of 999 years from the date of the lease, and control is given of the expenditure of any moneys belonging to the Metropolitan which, at the time of the taking over of the property under this lease, are in its treasury. The document sets forth that the Interurban shall at all times during the continuance of this lease operate and keep in good working order, condition and repair, at its own expense, all these lines of railway and other property, and all extensions and branches thereof, and all additions thereto.

The Interurban is to pay all taxes on the property or additions thereto or from the construction of other lines in connection therewith. The Interurban also is to pay all rentals under any lease to which the Metropolitan is a party.

In return for the lease the Interurban is to pay dividends amounting to seven per cent per annum on the existing capital stock of the company, and upon such additional capital stock which may be issued with the written consent of the Interurban. These dividends are to be paid quarterly, and they are to be guaranteed by the Interurban.

The next clause defines the rights of the Interurban, and provides that it may "abandon or sell any track, real estate, equipment, franchise, rights, or other property * * * provided that the continuity of no main line of railway shall be broken by such sale or abandonment."

All legal actions arising out of the operation of the road are also assumed by the Interurban.

The Metropolitan is to maintain its corporate existence at a cost of not more than $10,000 annually, and is to apply for all connections, extensions, branches, or changes of motive power as the Interurban may demand.

The Interurban has the right to mortgage the property, and to control it in every respect, for which purpose it is created the attorney irrevocable of the Metropolitan.

The Metropolitan's equity in all shares of stock of other railway companies acquired by it under its lease with the Third Avenue Railroad Company is transferred to the Interurban, subject to the prior lien of the mortgage of the Third Avenue Railroad Company to the Morton Trust Company, dated May 15, 1900, to secure an issue of $50,000,000, face value, four per cent first consolidated mortgage bonds of the Third Avenue Railroad Company, and the Interurban covenants that it will not transfer, assign, or encumber the shares of stock acquired under this lease of the Third Avenue Railroad Company.

The Interurban is to furnish the Metropolitan with $23,000,000 for the purpose of paying the unfunded debt of the Metropolitan, and to provide expenditures for other purposes; $5,000,000 of this is to be paid in forty days after the approval of the lease by the stockholders, and payments of $5,000,000 or more are to be made upon thirty days' notice.

After various stipulations it is finally provided that nothing in the lease shall prevent the consolidation or merger of the lessee with any other corporation, or any transference of its property, provided that no such transfer or lease shall be made without the consent of the lessor. Provision is also made for settlement of any difference which may arise by arbitration of three disinterested persons.

Unless some other date is hereafter agreed upon, the lease is to take effect on April 1.

The agreement between the Metropolitan Securities Company and the Interurban Street Railway Companies was also made public at the meeting of Metropolitan stockholders. According

to this document, the Interurban Company has an authorized capital of $20,000,000, all of which, except $500,000, is unissued, and has authorized an issue of $15,000,000 of ten-year three per cent debentures.

The agreement recites the terms of the lease of the Metropolitan Street Railway, and then provides that the Securities Company shall and does subscribe at par $12,500,000 par value of the capital stock and $15,000,000 face value of the debentures of the Interurban Company at such a price as to make the aggregate price of this stock and debentures $23,000,000, and agrees to pay this sum in such instalments as shall be necessary to enable the Interurban to pay $23,000,000 to the Metropolitan Street Railway, pursuant to the terms of the lease, and provided that after the payment of the first $5,000,000 no instalment shall be payable except upon thirty days' notice.

Stock certificates and debentures are to be delivered pro rata as payments are made. The Securities Company also agrees to advance or cause to be advanced such funds of money up to $5,000,000 as the Interurban may be called upon by the Metropolitan Street Railway to advance for construction purposes pursuant to the lease pending the ratification of this lease by the stockholders of the Metropolitan Street Railway.

The Interurban agrees that it will sell none of its unissued stock and none of its present or future obligations, except to the Securities Company, and that the Securities Company may at its option purchase any stock at par.

Immediately after the meeting a letter informing the stockholders of the ratification was mailed to each stockholder by the Securities Company, which contains the terms of the subscription to the stock of the Securities Company. This letter reads as follows:

"The lease between the Metropolitan Street Railway Company and the Interurban Street Railway Company having been approved by the stockholders of those companies pursuant to law, each stockholder of the Metropolitan Street Railway Company will be entitled to subscribe at par for an amount of the stock of the Metropolitan Securities Company equal to forty-five per cent of the par value of his holding of the capital stock of the Metropolitan Street Railway Company. Arrangements have been made with the Metropolitan Street Railway Company by which its transfer books will be closed at the close of business on Monday, March 31, 1902, for such subscriptions. As soon as practicable thereafter there will be mailed to each stockholder of record on such closing of the transfer books a subscription warrant specifying the number of shares of the stock of the Metropolitan Securities Company to which the holder is entitled to subscribe. Such subscription warrant will be accompanied by a subscription form and form of assignment. Provision will be made for splitting up subscription warrants into such amounts as may be directed. Subscriptions must be made at the office of the Morton Trust Company, No. 38 Nassau Street, New York, on or before Tuesday, April 15, 1902. Every subscription must be accompanied by a check to the order of the Morton Trust Company for an amount equal to $25 for each share of stock subscribed for. Further instalments will be payable upon not less than thirty days' notice by mail, as and when called for by the company. Unless certificates for partly paid stock are issued upon receipt of subscriptions, the Trust Company will issue its temporary receipts exchangeable for stock certificates when ready for delivery. No subscription or assignment of a subscription right will be recognized unless made on the warrants furnished by the company."

Another Bridge Plan

Still another plan for relieving the congestion at the Manhattan terminal of the Brooklyn Bridge has been evolved, and this latest plan, in its modesty, is in striking contrast with the $14,000,000-plan of Bridge Commissioner Lindenthal. Nels Poulson, president of the Hecla Iron Works, is the author of the plan, and on March 22 he made an offer in writing to put the plan in operation within three weeks' time, at an expense of not more than $25,000. Mr. Poulson supplemented the offer with a written guarantee that if the plan fails to give the promised relief, his company will pay all the expenses of construction and removal, and will restore the Manhattan terminal to its present condition without cost to the city of New York or the Brooklyn Rapid Transit Company. Mr. Poulson also guarantees not to interfere with traffic during construction. According to Mr. Poulson, the plan in the first place removes the danger of crossing the tracks at the loop. It substitutes for the confined area of 5000 sq. ft. or so, where the cars now load and unload, and the passengers dodge in and out between moving cars at constant peril of their lives, an area 520 ft. long and 50 ft. wide, 26,000 sq. ft. with no car tracks to cross. It furnishes eleven sidings for loading and unloading for the seventeen lines which run to New York from Brooklyn. It gives room for two cars on each siding, which will furnish ample accomodations for all the lines. Each car makes one siding, returns to the main line and goes around the loop to return to Brooklyn without interruption, according to the plan. According to Commissioner Lindenthal, both he and Mr. Martin, the consulting engineer of the department, consider the plan impracticable. President Greatsinger has asked Mr. Poulson to furnish him with plans, showing the exact changes that will have to be made, and has promised to give them his earnest attention.

The New Orleans Situation

About eight months ago, at the request of their employees, the New Orleans street railway companies advanced the wages of conductors and motormen from about 13 cents to 18 cents per hour, and shortened the day to 10 hours of platform work. The settlement was brought about largely through the efforts of Mayor Capdevielle, and with the distinct understanding between the companies and the employees that the agreement so reached was satisfactory to the latter and would be accepted absolutely by them. It has been evident for some time, however, that, encouraged by this act on the part of the companies, which was construed as a confession of weakness, the employees were about to make further demands on the companies. Early last week a mass-meeting of the employees was held to consider the situation, and resulted in the drawing up and submission on March 18 by the employees of the following among other propositions:

(1) That the workday for conductors and motormen shall be nine hours, to be completed inside of eleven consecutive hours, except for trippers, whose work is to be completed inside of fourteen consecutive hours.

(2) The wages for all motormen and conductors is to be 20 cents per hour.

(3) Recognition of the union in all matters pertaining to the employing and discharging of men.

The latter demands read as follows:

"6. All motormen and conductors are to be members in good standing of this association. This section to in no way interfere with the company in their selecting or hiring employees, the rule to be that where the company employs new men, these men shall work sixty (60) days, and if at the end of that period they are satisfactory to the company, they shall then become members of the association. Any motorman or conductor at the present time in the employment of the company and not a member of the association shall become a member within the next sixty (60) days from the date of this agreement.

"7. All business between the parties hereto shall be transacted through the properly accredited officers of the company and the properly accredited committees of the association, with the exception of the cases or complaints that might arise over conductors who have been discharged for missing or other irregularities in the collection of fares. It being understood that the committee to treat with this company shall be selected from the regular employees of the company."

It is needless that the companies will not grant these demands. They particularly object to the request that they turn over the matter of engaging employees to the self-constituted committee, and pointed out the impossibility of doing this in a letter to the Mayor written March 15, when it was reported that such a demand would be made upon them, but before its actual publication. The letter referred to follows:

"New Orleans, March 15, 1902.

"Hon. Paul Capdevielle, Mayor of the city of New Orleans, New Orleans, La.:

"Dear Sir—As you exhibited your care for the public welfare last year by lending your kind and able assistance to the settlement of a pending controversy between the undersigned street railway companies and their employees, we take the liberty of addressing you this communication, because we are informed by the public prints that a non-resident, not in any way connected with this city, nor interested in its peace, comfort and well-being, is now here conferring with our employees and organizing them for the purpose of formulating and presenting, in the near future, demands upon us, the central and principal one of which is that these companies shall recognize a labor union composed of these employees.

"We understand that what is meant by the term 'recognition of the union,' which this non-resident is formulating for presentation to us, is:

"1. That we shall not have the right to employ and that we shall not employ in our service any person who is not a member of such union in good standing.

"2. That we shall not have the right to discharge and shall not discharge any employee without the consent of said union.

"We are further informed that an all-night meeting of our employees will be held this very night, under the leadership and auspices of this non-resident, to agree upon the demands to be presented to us.

"If we are right in our understanding that the principal point to be presented to us is 'recognition of the union,' and that this recognition means what we have stated above, then we feel compelled to make to you, and through you to the public and to our employees, the announcement that, under no circum-

stances whatever and under no pressure or persuasion, will we accede to this demand. We can not and will not consent to surrender control of properties like these, affected with a public interest, standing in such vital relations to the business, the safety, the comfort, the health and the happiness of the community, representing such large investments of capital and contributing such large sums to the support of the public functions of this municipality, into the hands of our employees, among whom discipline is necessary and over whom discipline can never be enforced under such circumstances.

"In our judgment, the granting of any such demand would impair our ownership, cripple our control, and ultimately result in the destruction of our properties and the grievous injury of the public.

"If our employees have any grievance as to hours, wages or rules, we individually and collectively stand ready at all times to confer with them, to discuss and adjust amicably and fairly all differences thereto pertaining, and in proper cases to submit our differences to arbitration.

"We feel confident, Mr. Mayor, that if any struggle is to come over these matters, we shall have your support and countenance, and the good-will and backing of the community at large.

"We beg leave to subscribe ourselves, your obedient servants,

"By order of the Board of Directors, The New Orleans City Railway Company, R. M. Walmsley, President.

"By order of the Board of Directors, The New Orleans and Carrollton Railroad, Light & Power Company, Jos. H. De Grange, Vice-President.

"By order of the Board of Directors, The St. Charles Street Railroad Company, Albert G. Phelps, President.

"By order of the Board of Directors, The Orleans Railroad Company, Ed. Eisenhauer, President."

New Jersey Franchise Taxes

The State Board of Assessors has sent out notices to the local taxing authorities informing them of the amount of franchise tax that had been apportioned to each under the Voorhees Act of 1900, imposing a tax of two per cent on the gross receipts of the companies and corporations using the public streets and highways. The amount of tax apportioned is $316,704, computed upon gross receipts of $15,835,182. The gross receipts and the tax to be paid by corporations of different classes are as follows:

Companies	Gross Receipts.	Tax.
Street railway companies	$7,590,290	$151,805
Gas and electric companies	5,815,996	116,319
Telephone and telegraph companies	1,183,536	23,771
Water companies	982,000	19,640
Oil and pipe line companies	136,643	2,733
Sewer companies	85,933	1,719
District telephone companies	35,785	716
Total	$15,835,183	$316,704

The money apportioned will be paid by the different companies to the local tax receivers. The cities receiving the largest amounts are: Newark, $63,688; Jersey City, $42,790; Paterson, $24,622; Hoboken, $16,855; Trenton, $10,507; Camden, $10,636.

An Important Canadian Measure

The government bill to regulate the construction of electric railways in the Province of Ontario, Canada, has been passed. The measure becomes effective at once, and it is a most important one to the electric railways. It creates a railway committee from the government to deal with a variety of railway matters, all of which are specified at great length in the measure. It is of great importance, in that it takes control of railway matters out of the hands of the municipalities and vests them in the hands of the government, save and excepting the city of Toronto, which is exempted from this provision. It empowers every electric railway to connect its lines with any other such railway at any point, and the right to make traffic arrangement with other companies without having to get the assent of the municipalities, is also given. The agreement may be refused by the railway committee or accepted in part, but there is no power given to the committee to add to such an agreement, either on their own account or on behalf of any municipality. The companies may appeal to the Lieutenant-Governor in Council, but no voice is given to municipalities in any shape or form. Compensation for the increased burden on the highways may be given as against one railway company to the other, but none to the municipality. Traffic arrangements all over the line, interchange of cars, speed, and, in fact, general control is given to this committee. The bill, in short, takes the control of electric railways from the municipalities affected by them, and gives it to the new railway committee, which will assist in developing the electric railway system of Ontario, by removing vexatious opposition.

The San Francisco Consolidation.

According to the official statement of Brown Brothers, of New York, who are financing the consolidation of the street railways of San Francisco, and as previously announced in the Street Railway Journal, two companies are directly connected with the plans for taking over the San Francisco properties. The United Railways Investment Company, of San Francisco, has been formed under New Jersey laws, and will be used as a medium to transfer the securities of the various San Francisco companies to the new company, which will operate the properties. This operating company will be known as the United Railroads, of San Francisco.

The capitalization of the United Railroads will be as follows:

General first mortgage four per cent 25-year gold bonds	$35,275,000
Reserved for underlying liens ($14,591,000, less $4,725,000, to be discharged by operation of sinking funds under existing mortgages) and future betterments, improvements and acquisitions	15,275,000
To be issued in part payment for the stocks of the general companies and for $1,600,000 cash to be used for the betterments and improvements	20,000,000
Preferred stock, four per cent and not more, cumulative, preferred as to dividends and capital	20,000,000
Common stock	20,000,000

The income above five per cent on the common stock will be reserved and applied as a sinking fund for the payment of the bonds or for the improvement of the property.

The participants in the syndicate will receive for each $1,000 paid in by them, the total amount of cash provided being $26,375,000, $758.29 in the general first mortgage four per cent gold bonds of the United Railroads, of San Francisco, or the proceeds thereof, if said bonds shall be sold by "managers"; $568.72 par value of the five per cent preferred stock of the United Railways Investment Company, of San Francisco, and $189.57 par value of the common stock of last-named company. The remainder of the common stock of last-named company and the amount of cash subscribed by "participants" not paid over to said company under the plan of purchase for the use of the United Railroads, of San Francisco, as provided in said plan shall be paid over to "managers" as the representatives of holders of whom it is understood "managers" are one.

The entire capital stock of the United Railroads Company will, as previously stated, be held by the United Railways Investment Company, which will issue, in lieu thereof, $15,0000,000 five per cent cumulative preferred stock, retirable at 110 per cent, and $10,000,000 of common stock. The only securities of the new companies to be on the market will, therefore, be the $25,000,000 stock of the Investment Company, and the bonds of the United Railroads Company.

The Cleveland Situation

The existing companies and the Hoefgen 3-cent fare line promoters in Cleveland each won an important point last week in the fight for the building of the low-fare lines.

With only two dissenting votes the Council passed the ordinance granting a franchise to John Hoefgen for lines over three routes. The streets covered by the grant are: Rhodes, Willett, Fulton, Hanover, Viaduct, Superior, Oregon, Oliver, St. Clair, Sterling, Hamilton, Marquette, East Stanard, Norwood, Wade Park, and Rosedale, forming a line almost across the city, and Monroe, Columbus, Center, South Water, Champlain. and Ontario, forming a connecting line through the section of the city known as the "flats." More than one-third of the two routes cover what is known as free territory and the lines will have to straddle existing tracks. The route of the main line through the city is extremely circuitous and trips could be made over the routes in much faster time by the existing lines than will be possible with the new lines. Mayor Johnson announces that work will start as soon as the franchises become operative.

The Circuit Court has overruled the decision of the lower court in the case of Hoefgen against the existing companies, to restrain them from interfering with the work of securing right of way and consents for the 3-cent fare lines. Judge Hale said in part:

"Neither the city nor Hoefgen has any cause for action against the lot owners. They may give or withhold consents, as they see fit. Whatever their course may be, they incur no legal liability. The reasons or motives which may prompt them to give or withdraw consents are immaterial. The morality of the act which the petition seeks to prevent is not for this court to pass upon until a point has been reached where some legal or equitable right has been invaded. The remedy must be sought in the Legislature and not ir the courts."

The decision practically gives the existing companies the right to interfere with future projects of the kind by purchasing the withdrawals of consents.

Investigation Into the Conductivity of Alloys of Iron

An elaborate paper was read on the above subject, Feb. 13, by W. F. Barrett and W. Brown before the Institution of Electrical Engineers at London. Some of the results of the investigation on the conductivity of iron are presented below in the accompanying table. The sample of iron marked S. C. I. was that taken as standard for annealed iron, and had the following composition:

Iron	99.89
Carbon	0.028
Silicon	0.07
Sulphur	0.005
Phosphorus	0.004
Manganese	trace
	99.997

INVESTIGATION INTO THE CONDUCTIVITY OF ALLOY OF IRON

GROUP	PERCENTAGE COMPOSITION				ELECTRICAL CONDUCTIVITY		SPECIFIC RESISTANCE
	Fe.	C.	Mn.	Si.	Iron = 100	Copper=100	
Standard (S. C. I.)							
Carbon Series (A.)	99.89	0.028		0.07	100.	16.8	10.2
	99.71	.03	0.036	.14	93.4	15.7	10.9
	99.72	.05	.18	.02	90.4	15.2	11.3
	99.00	.14		.08	80.4	13 5	12.7
	99.02	.78	.10	.10	70.3	11.8	14.6
	98 86	.83	.25	.06	67.3	11.3	15.2
	98.78	.84	.18	.20	63.7	10.7	16.1
	98.66	.85	.32	.17	62.5	10.5	16.4
	98 42	1.09	.32	.17	58.9	9.9	17.4
	98.51	1.23	.14	.12	58.3	9.8	17.6
(B.)	98.35	.58	.58	.49	49.4	8.3	20.7
	97.93	1.00	.58	.49	45.8	7.7	22.3
	97.67	1.25	.62	.46	43.5	7.3	23 6
Manganese Series (A.)	99.30	.20	.50		70.8	11.9	14.5
	98.76	.24	1.00		43.5	7.3	23.6
	97.34	.41	2.25		35.1	5 9	29.2
	96.29	.08	3.50	.13	34.5	5.8	29.7
	95.64	.36	4.00		35.7	6.0	28.7
	94.89	.36	4.75		34.9	5 86	29.4
	94.53	.32	5.15		27.4	4.6	37.4
	94.46	.15	5.40		30.4	5.1	33.7
	86 74	.26	13.00		16.7	2.8	61.8
	84.64	.15	15.20		15.8	2.65	64.9
(B.)	95.41	.78	3.81		23.2	3.9	44.1
	91 80	1.20	7.00		18.5	3.1	58.7
	89.11	.16	10.10	.63	16.1	2.7	63.7
	86.84	1.66	11.50		16.7	2.8	61.5
	85.77	1.23	13.00		16.1	2.7	63.7
	83.25	1.50	15.25		15.5	2.6	66.2
	80.96	1.54	18.50		14.9	2.5	69.0

	PERCENTAGE COMPOSITION							
	Fe.	C.	Mn.	Ni.	Si.			
Nickel Series (A.)	97.01	0.11	0.72	1.92	0.21	50.0	8.4	20.44
	95.14	.19	.65	3.82	.20	42.8	7.2	24.6
	87.28	.18	.93	11.39	.22	28.6	4.8	35.8
	78.97	.19	.93	19.64	.27	26.2	4.4	39.0
	74.03	.16	1.00	24.51	.30	22.6	3.8	45.1
(B.)	67.08	.70	.82	31.40		11.9	2.0	86.0
	98.25	.75	1.00			38.1	6 4	26.9
	97.50	.50	1.00	1.00		36.3	6.1	28.0
	99.16	.22	.18		.44	60.1	10.1	17.0
	98.65	.26	.18	.58	.33	57.3	9.6	17.9
	85.49	.81	.61	12.70	.39	23.2	3.9	44.1
	85.75	.98	.61	12.10	.56	22.6	3.8	45.3
	67.90	.60	1.50	30.00		11.6	1.95	88.2
				W.				
Tungsten Series	98.73	.16	.11	1.00		67.9	11.4	15.1
	95.94	.28	.28	4.50		57.3	9.6	18.0
	91.92	.38	.20	7.50		53.0	8.9	19 2
	83.46	.76	.28	15.50		38.1	6.4	26.6
				Al.				
Aluminium Series	98.98	.17		0.75	.10	46.4	7.8	22.0
	97.33	.24		2.25	.18	26.2	4.4	39.0
	94.08	.22		5.50	.20	14.9	2.5	70.0
Silicon Series	97.30	.20			2.50	24.4	4.1	42.1
	94.24	.26			5.50	15.7	2.6	65.2
				Cr.				
Chromium Series	97.10	.90		2.00		42.3	7.1	24.2
	97.32	.43		3.25		41.1	6.9	24.9
	89.45	1.09		9.50		26.8	4.5	38.2
				Cu.				
Copper Series	97.37	.68	.36	1.59		68.4	11.5	14.9
	96.59	.59	.32	2.50		70.8	11.9	14.4
	95.92	.17	1.04	2.87	Al.	58.3	9.8	17.4
	95.05	.04	.16	3.75	1.00	48.2	8.1	21.0

This iron was made into a rod 104 cm long and carefully turned to a uniform diameter throughout its entire length; its sectional area was 0.1874 sq. cm. Its specific resistance was found to be 10.47 microhms by cubic centimeters.

A hard-drawn electrolytic copper test piece was made of the same dimensions for a copper standard, and its resistance was found to be 1.721 microhms, both iron and copper being measured at 18 degs. C. The conductivity of the iron deduced from these values is 16.44. Comparing the conductivity of the standard iron rod with the iron wire, the former was found to be 16.5 and the latter 16.4, Matthiessen's cooper being taken as 100, this slight difference between the iron rod and iron wire being due to some variation in hardness in the two specimens, which had not been specially annealed. When the wire was carefully annealed its conductivity rose to 16.78, copper, as before, being 100. The copper was found in Lord Kelvin's laboratory to be 1.01 per cent higher conductivity than Matthiessen's pure hard-drawn copper.

The paper shows the resistance and permeability of a large number of other compositions, both in tabular form and graphically. From the many interesting points brought out in the paper two will be mentioned here, the reader being referred to the original paper for further information on the subject.

One is that the greatest reduction of conductivity for a given percentage of the added element is produced by the *first* increments of the element added. As the percentage increases, i. e., as the alloy becomes richer, the effect of corresponding increments—so far as the electric conductivity is concerned—becomes less, and in the case of the more highly resisting alloys, such as nickel and manganese, the difference between the conductivity of a 13 per cent and 18 per cent alloy is hardly perceptible. In a word, the curves fall steeply and tend to became asymptotic when the amount of alloy is largest and the conductivity is reduced to a certain low value.

The other important point for users of wire resistances is that the highest electrical resistance of any known metallic wire, commercially useful, has been found in some of these composite iron alloys. Thus an alloy of 25 per cent of nickel and 5 per cent of manganese has a specific resistance of 97.5 microhms and a comparatively low temperature coefficient. This alloy is easily drawn into wire, and appears to undergo but little change in heating, and is not an expensive product. The alloy containing 15 per cent of nickel and 5 per cent of manganese, which was originally called rheostene and is now known as resista, has been used largely for this purpose. Various makers have given other names to these alloys, and they are to be had on the market. For six years all of the resistance coils used in the electric installation and lecture theater in the Royal College of Science have been made of rheostene, and no depreciation of the material has been noticed.

A Plausible Impostor

Recent reports indicate that the impostor against whom this paper warned its readers two months ago is still carrying on his operations among electrical and street railway supply houses. His usual method is to introduce himself as a son of some prominent British manufacturer or railway manager. After talking about placing a large order with the person on whom he is calling he states that he was robbed the night before and is temporarily out of money, while awaiting a cable remittance from home. His plausible manner and excellent acquaintance with English tramway matters, together with the fact that he always takes care before calling to post himself well in regard to the business of the person whom he has selected as a victim, usually disarm suspicion and result in his securing a small loan. To the description of this swindler previously published, i. e., height about 5 ft. 8 ins. and age from twenty-five years to thirty years, the fact might be added that his upper teeth are very prominent and irregular or broken. So far as his operations seem to have been confined to New York City.

The Akron-Alliance Connecting Railway Company

Articles of incorporation of the Akron-Alliance Connecting Railway Company were filed in the office of the Secretary of State at Columbus, Ohio, on the 13th instant, for the carrying of passengers, freight, express and United States mail matter between the cities named and intermediate points; the capital stock is $100,000, which will be increased.

The incorporators are R. D. Gibby, of New Jersey; Hugh Bleakly, Charles S. Keith, Henry Shaffer and B. F. Weybrecht, of Ohio. The company is now fully organized, and the principal office is at Alliance, Ohio, and that of President R. D. Gibby is Room 51, 60 Liberty Street, New York. The road will be about 30 miles in length, and will be double-tracked the entire distance.

This will connect Alliance and Cleveland by direct electric roads, lessening the distance between Akron and Alliance by some 35 miles, and the same to Cleveland.

European Rails for Mexican Tramways

The Mexican Electric Tramways Company, of the City of Mexico, whose entire purchases for equipment, etc., have hitherto been made in the United States, is about to place a contract for 700 tons of rails in Europe because of better inducements being made by competitors on the other side. The rails are to be of 90-lb. weight, and to be used for an extension of the company's system.

Universal Transfers in Chicago

Judge Hall, in the Circuit Court, on March 19, entered a ruling in which he holds as valid the city ordinance compelling the Union Traction Company to issue transfers on all its lines and systems. Incidentally the court holds that the municipality has the legal right to regulate street car fares. The case will go to the Supreme Court. Judge Hall also ruled that the Union Traction Company and the Consolidated Traction Company are practically one company, and one company must recognize the transfer of the other, and that a 5-cent fare to all points within the city limits shall be the maximum fare.

As a result of this decision, the citizens of the south end of Austin engaged the employees of the Union and Consolidated Traction Companies hand to hand in a fight for universal transfers on March 25.

Eighteen men, according to reports, rode back and forth on the West Madison Street lines, demanding transfers from the trolley to the cable and back again. They were refused, as had been expected, and the efforts of the street car crews to eject them from the cars resulted in two battles, which tied up both lines for some time. A large number of suits against the companies are threatened as a result of the fight.

The North Jersey Street Railway Company's Annual Meeting—Its Plans to Enter New York

At the annual meeting of the North Jersey Street Railway Company, held in Jersey City on March 24, it was announced that plans for extensions and improvements to cost $1,000,000 had recently been made. These improvements and extensions are made necessary not only because of the rapidly increasing traffic, but also because of the increased demands that will be made upon the system when the company shall begin to operate its cars to connect with the proposed tunnel to New York. It is in connection with the tunnel project that the most important improvement—a 17-mile belt line to connect the Pennsylvania Railroad terminal at Jersey City with Bergen Point—is to be made.

The North Jersey Street Railway Company's cars and the cars of the Jersey City, Hoboken & Paterson Street Railway Company are to operate to the Jersey City terminal of this tunnel, at Fifteenth Street, where the passengers may be transferred to the smaller cars of the tunnel company. In these cars the passengers may be taken under the Hudson River to New York, where connection can be made with the Metropolitan Street Railway Company's system. The North Jersey Street Railway Company, as a company, assumes no responsibilities in connection with this tunnel project. It merely agrees to take its passengers to the mouth of the tunnel and facilitate their transfer to the tunnel company's cars.

The annual report for 1901 shows that the receipts from passengers were $4,151,411, and from other sources $21,236. The operating expenses were $1,994,988, making the net earnings $2,177,658. From this was deducted $2,063,889, leaving a surplus of $113,769.

The following officers were elected at the meeting: E. F. C. Young, A. J. Cassatt, P. A. B. Widener, Thomas Dolan, John D. Crimmins, J. Roosevelt Shanley, Leslie D. Ward, William L. Elkins, United States Senator John F. Dryden, Peter Hauck, John F. Kehoe, Joseph D. Bedle, David Young, Edward L. Young and George F. Perkins, directors; E. F. C. Young, president; David Young, vice-president and general manager; William F. Johnson, secretary; E. N. Hill, treasurer; E. H. Hibbe, auditor.

The Consolidated Traction Company also held its annual meeting on March 24, and elected these directors: E. F. C. Young, Elisha B. Gaddis, R. C. Jenkinson, Leslie D. Ward, J. E. Hulshizer, Albert G. Jennings, William J. Davis, of Harrison; B. M. Shanley, John E. McArthur, Dudley Farrand, J. K. Corbierre, David Young, Clement A. Griscom, Jeremiah O'Rourke, Michael T. Barrett.

The dividends in 1899, 1900 and 1901 on the North Jersey Street Railway Company's stock were 2 per cent for the year, and this year the dividend rate will be 2½ per cent. In 1903 and 1904, it is planned, it will be 3 per cent, in 1905 3½ per cent, and thereafter 4 per cent.

Northern Indiana Traction Company

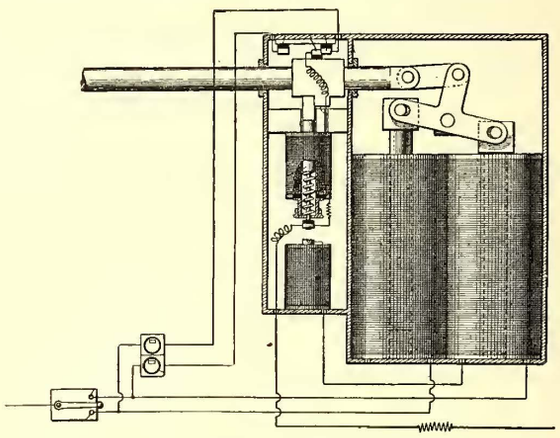
Clarence Storms, Charles E. Orvin, Ralph H. Beach and W. E. Simpson, of New York, are promoting the Northern Indiana Traction Company, which has just been organized with $800,000 capital and a bond issue of $1,500,000. Flint, Jones & Company, of New York, have the contract for the road. W. A. Pearson, the electrical engineer of the Metropolitan Street Railway Company, of New York, is the consulting engineer, and C. E. Shackford, of New York, is the supervising engineer.

Street Railway Patents

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

UNITED STATES PATENTS ISSUED MARCH 18, 1902

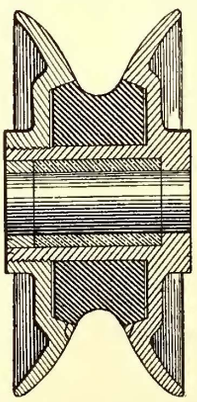
695,440. Electrical Switch; R. L. Border, Pittsburgh, Pa. App. filed July 15, 1901. Two solenoids are mounted on a pole beside the track and connected mechanically with the switch-point. The motorman can throw the circuit from one solenoid to the other and thus move the switch.



PATENT NO. 695,563

695,506. Trolley; M. Stoll and J. W. Buck, Pittsburgh, Pa. App. filed June 21, 1901. A pair of spring arms support a pair of rollers immediately above the trolley wheel to retain the latter in place on the wire.

695,547. Brake-Head; J. Farley, Waukesha, Wis. App. filed Oct. 9, 1901. The brake-head is provided with a beak and link relatively arranged so that the hanger can only be inserted or withdrawn when canted from its normal operative position.



PATENT NO. 695,861

695,563. Electrically Operated Switch; E. V. R. Ketchum, New York, N. Y. App. filed May 15, 1901. Two solenoids are connected with the switch-tongue, each movement of which changes the circuits from one solenoid to the other and also operates an indicator circuit to show whether the switch is in proper position or not.

695,849. Roller Side-Bearing; J. C. Wands, St. Louis, Mo. App. filed Nov. 8, 1901. A spring is arranged so that the rollers are returned to a central position after each movement and independently of the movement of the top bearings.

695,861. Electric Contact Device; N. C. Cotabish, Lakewood, Ohio. App. filed April 16, 1901. A trolley wheel having a removable carbon tread.

ENGINEERING SOCIETIES

BROOKLYN ENGINEERS' CLUB.—A meeting of the club will be held at its headquarters, 191 Montague Street, on March 27, at which there will be an informal discussion on "Some General Features of the Blackwell's Island Bridge." The discussion will be introduced by R. C. Strachan.

BOSTON SOCIETY OF CIVIL ENGINEERS.—The annual meeting of the society was held March 19 in Chipman Hall, Tremont Temple, Boston, and the result of the election of officers was as follows: George A. Kimball, president; Fred. Brooks, vice-president; S. Everett Tuckham, secretary; Edward W. Howe, treasurer; George B. Francis, director. President Kimball is well known in Massachusetts, having served a number of years as city engineer of Somerville, member of the Metropolitan Sewerage Commission and chief engineer of elevated lines of the Boston Elevated Railway Company, which latter position he still holds. The entire construction of the elevated system in Boston was carried out under Mr. Kimball's immediate charge. Mr. Kimball was elected a member of the society April 28, 1875.

PERSONAL MENTION

MR. C. F. FRANKLIN, formerly general superintendent of the Clover Leaf Railroad (steam), has been appointed general manager of the Toledo & Western Railway, of Toledo, Ohio.

MR. WILLIAM McWHORTER has resigned his position as master mechanic for the Savannah Electric Company, of Savannah, Ga., to accept a similar position with the Georgia Railway & Electric Company, of Atlanta.

MR. D. H. LAVENBERG has been appointed superintendent of the Dallas & Oak Cliff Electric Railway Company, of Dallas, Tex., to succeed Mr. B. F. Sibert, who has accepted the position of general manager of the Laclede Light & Power Company, of St. Louis, Mo.

MR. E. KESSLER, who for the past nine years has been superintendent of the Richmond Street & Interurban Railway Company, and general manager of the Richmond Traction Company, of Richmond, Ind., has resigned from these companies, and will engage in the banking business at Milton, Ind.

MR. AUGUSTUS M. MOORE, formerly master mechanic for the Atlanta Rapid Transit Company, of Atlanta, Ga., has been appointed chief engineer of the Georgia Railway & Electric Company, of Atlanta, succeeding Mr. Thomas Elliott, who resigned to accept a position with the Pittsburgh, McKeesport & Duquesne Street Railway, of Pittsburgh, Pa.

MESSRS. E. P. BRYAN, general manager of the Rapid Transit Tunnel Railroad, of New York; S. L. F. Deyo, chief engineer, L. B. Stillwell, electrical director; J. Van Vleck, mechanical engineer, and George Gibbs, consulting engineer, left New York last week on Mr. August Belmont's private car on a tour of inspection of various electric railways in the West. The trip is in anticipation of the award of certain large contracts for electrical apparatus in the early future.

MR. R. PERCY SELLON, of the Brush Electric Engineering Company, Limited, of England, is now on a trip to this country, which he has reached via the West Indies, where he and his wife have made a winter tour of recreation. Mr. Sellon is an active member of the English Institution of Electrical Engineers and English official bodies interested in standardization of apparatus, and while here is studying up the work done by the American Institute of Electrical Engineers in that direction.

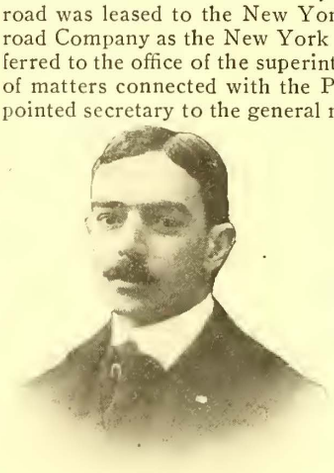
MR. HENRY S. LOWD, of the British Westinghouse Electric & Manufacturing Company, Limited, who has been busily engaged at Pittsburgh for several months past in connection with the placing of the machinery contracts, etc., for the British Company's new works now being hastened to completion at Trafford Park, near Manchester, will sail next month for Europe, in order to assume the general managership of the English works. Mr. Lowd, who is a Brooklyn (N. Y.) man, was formerly general manager of the Nicopol Mining & Metallurgical Company's works, South Russia.

MR. HARRY A. NICHOLL has resigned as superintendent of the Rochester Railway Company, of Rochester, N. Y., to accept the positions of assistant manager and treasurer of the Ithaca Street Railway Company, the Brush-Swan Electric Light Company, and the Cayuga Lake Railway Company, of Ithaca, N. Y., all of which are under one management. Mr. Nicholl has had wide experience in railroading, having been connected with both steam and electric lines since the completion of his schooling. Among the roads he has been connected with are the Chicago & Northwestern; Natchez, Jackson & Columbus; Yazoo & Mississippi Valley; Illinois Central; North Side Electric, of Chattanooga; Signal Mountain, of Chattanooga, and the Rochester & Sodus Bay Railroad, the construction of which he superintended.

MR. JOSEPH H. O'BRIEN, who for the last two years has been first assistant to Mr. George B. Francis, chief engineer of the Rhode Island Suburban Railway Company, Providence, R. I., has accepted the position of assistant to Mr. A. B. Corthell, terminal engineer of the New York Central Railroad. Mr. O'Brien was for some time associated with Mr. Corthell when the latter was resident engineer of the Boston Terminal Company during the construction of the new "South Station" in Boston. He will be in charge of the draftsmen of the department now busily engaged in perfecting plans for increasing the terminal facilities at the Grand Central Station, in anticipation of equipping the railroad with electricity.

MR. JOHN S. HAMLIN, master mechanic of the United Traction Company, of Indiana, has just been appointed manager of sales and construction of Chicago, for the United States Steel Company, manager of the Neal duplex brake. Mr. Hamlin has had a long experience in railway operation and has given especial attention to the subject of brakes. In 1888 he entered the employ of the North Chicago Street Railway Company as a driver and remained with that company until 1893, when he went with the North Chicago Shore Street Railway Company on line construction and was afterward engaged in the shops. While in the employ of this company he installed the first axle-driven air brake made by the Christensen Engineering Company. In 1895 he resigned to accept a position with the Metropolitan Elevated Railway Company and was the first man to run a car across the Chicago River on that system. He also, for some time, had charge of the air brake equipments of this road and installed the first motor-driven compressor made by the Christensen Company. He afterward went with that company and remained with it until he accepted the position of master mechanic of the Union Traction Company, of Indiana. This was about a year ago, and while connected with this company Mr. Hamlin has carried on a series of extensive tests on braking, some results of which have been published in these columns.

MR. RICHARD W. MEADE has recently been appointed assistant to the president of the Metropolitan Street Railway Company, of New York. Mr. Meade, though a young man, has had a long experience in railroading, a large part of which has been acquired with steam railroads. He entered railway service Oct. 1, 1889, in the executive offices of the New York & Northern and St. Paul & Duluth Railroad Companies. On July 1, 1891, he was appointed secretary and chief clerk to the general superintendent of the New York & Northern Railway Company, and in 1894, when this road was leased to the New York Central & Hudson River Railroad Company as the New York & Putnam Division, he was transferred to the office of the superintendent of that company in charge of matters connected with the Putnam road. In 1896 he was appointed secretary to the general manager of the New York Central Railroad. On the outbreak of the recent Spanish war he resigned from the Central to enter the United States Navy, and served throughout the war as boatswain's mate on the U. S. S. "Yankee," most of the time being spent off the coast of Cuba. At the close of the war he re-entered the service of the New York Central & Hudson River Railroad Company in the general superintendent's office, and on Feb. 1, 1899, was appointed chief clerk to the superintendent of the Hudson Division of the same company. A month later he was promoted to be general foreman at Sixtieth Street, North River, the main New York terminal of the New York Central & Hudson River Railroad for the distribution, storage and lighterage of carload freight, his duties later being extended to include the lighterage as well as the transportation department. Mr. Meade held this position until Feb. 1, 1902, when he resigned to accept the position above mentioned with the Metropolitan Street Railway Company. This position is necessarily one requiring a great deal of detail work, but Mr. Meade has already shown a marked acquaintance with street railway matters, and will bring to his work a fund of valuable experience acquired in steam railroad service.



RICHARD W. MEADE.

FINANCIAL INTELLIGENCE

THE MARKETS

The Money Market

Wall Street March 26, 1902.

Practically the same features noted in this article last Wednesday have distinguished the money market again this week. The one new development was an unexpected increase in the shipments of currency to the interior centers. Commonly, the outflow of funds continues to overtop the sum coming into New York up to the middle of April, so that the week's sudden enlarging of the outward movement was by no means abnormal. The incident was surprising, however, in view of the indications which appeared a week ago, that the higher money rates locally had begun to attract increased offerings of capital from other cities. This, banking authorities contend, will be the result in case the advance in money were to go much further. All that the week's experience has actually demonstrated, however, is that money has not reached a high enough level at this center yet to turn the domestic exchanges from what is their natural course at this season. The cash holdings of the banks were sustained in last Saturday's statement by the heavy disbursements of the Treasury in the final days of the government bond redemption offer. Now, however, this source of gain is closed, and the Treasury will in all probability be a creditor again in its operations with the New York banks. A further, though perhaps moderate, decline in cash supplies is likely to occur, lasting until the middle of next month, when the real return of currency from the centers of interior trade begins. This cash loss will have to be offset by further loan contraction, and the only way this can be done without causing disturbance is to keep money rates high enough to induce trust companies and other outside lenders to continue drawing down their Clearing House deposits. By this means, as has been the case for the last two weeks, both loans and liabilities of the Associated Banks will be reduced, without curtailing the actual supply of capital at the disposal of local borrowers. Continuation of the present relatively high money quotations may, accordingly, be expected for some time. Call loans at the Stock Exchange generally command between 4½ per cent and 5 per cent, and time loans, on good mixed collateral, 4½ per cent.

The Stock Market

The stock market this week has again been singularly lacking in important incidents. There is no change in the speculative conditions, as they have been pointed out in the last few articles in this column. Operations for the rise, conducted chiefly by a group of Western professional speculators, led to some sharp advances among the standard shares toward the close of last week, but when serious efforts were made to take profits prices quickly relapsed again. Comparing the price level with what it was a week ago, advances predominate over declines, but inasmuch as the range of speculative interest has not broadened, and the support of outside buying orders, which is essential to any sustained upward movement, is wholly wanting, the speculative situation cannot be said to have undergone any real improvement. The comparatively high rates for money are a restraining factor; the threatened strike of the anthracite coal miners is another. But neither of these can be considered of lasting consequence. What the community is awaiting more than anything else is the satisfactory progress of the season's grain crops. Another year of normal agricultural prosperity would dissipate all remaining doubts as to the maintenance of the present trade volume and maximum railway earnings, and almost certainly would inspire a more liberal policy regarding the payment of dividends on the part of many of the railroad managements. It is plain that the course of security prices during the next few months will be governed more by news from the harvest sections than by any other single influence.

The suit of the minority holders in the Metropolitan Company to permanently enjoin the lease of the property to the Interurban Railway Company has attracted considerable interest, although few expect that anything will come of it. A decision will probably be handed down in a day or two, and unless the transfer is blocked by the courts the subscriptions to the new Metropolitan Securities stock will be opened on Monday. These subscription privileges are now quoted at 12⅝, and the stock "when issued" at 130½, both of which represent a decided advance over a week ago. The quotations are regarded, however, as purely nominal. Profit-taking has caused a partial reaction in Manhattan during the week, but the stock continues to be well bought on the declines. The beginning of the electric service on the Third Avenue line has had a favorable effect on the market. Fluctuations in Brooklyn Rapid Transit have been extremely erratic. The shares rose sharply after the stockholders' meeting had ratified the $150,000,000 bond issue, but attempts to realize by the leading speculative interests caused a quick decline.

Philadelphia

Dealings in Union Traction continue on a fairly large scale considering the small dimensions of the general market. The information recently obtained from semi-official sources, that few of the present directors will remain on the board after the prospective merger takes place, indicates the growth of a new financial interest in the property. This fact alone would be sufficient to account for the steady buying which has been visible for some time past in Union Traction shares, and their steadily advancing prices. The quotation has again mounted to 40½ during the week, which represents the highest figure on the movement. Philadelphia Traction, on the other hand, has been dull and barely steady around 98. A few scattered purchases of Consolidated Traction of New Jersey at 70¼ was the only response made to the annual report of the North Jersey Company, issued this week, and to the statement by President Young that $1,000,000 would shortly be spent in extending and improving the property. The only other traction dealings of the week were small sales of Fairmount Park Transportation at 23, and of Indianapolis Street Railway at 50 and 53. In the bond department, Electric-People's Traction 4s recovered a fraction to 98⅜, and small transactions occurred in Indianapolis Railway 4s at 85, Wilmington and Chester 5s at 108¼, Consolidated of New Jersey 5s at 110½, People's Passenger 4s at 106½ and Union Traction of Indiana 5s at 101⅛.

Chicago

Interest in the Chicago market during the week centered entirely in the negotions for the consolidation of the Union Traction and City Railway Companies. Both stocks have had a sharp rise, Union Traction common going up from 17½ to 21, and City Railway from 223 to 225. An important conference which presumably took up the terms of the merger was held in New York, but the public so far have not been enlightened regarding the proceedings. There seems to be no doubt, however, that the negotiations will result satisfactorily in a complete unification of the entire Chicago surface lines. In view of the speculative enthusiasm over the prospect, a favorable construction was even placed upon the decision compelling the Union Traction and the City Railway to exchange transfers because the decision found its main point in the pronouncement that the two roads were practically one. The City Council has invited the traction officials to meet with them any time before June, to discuss the question of franchise extension. It is not regarded as probable, however, that the matter will be fully gone through with until after the city election for fear that it would provide a political issue. Elevated shares have again been strong this week, with Metropolitan up to 42 and South Side to 115. These are the highest prices of the season. Lake Street has developed exceptional activity, with the quotation up two points to 13⅝. No reason apart from the record-breaking earnings is apparent for any of these movements.

Other Traction Securities

In the Boston market Boston Elevated reacted slightly after its recent very sharp rise. It is down on scattering realizing sales from 170 to 169¼. Massachusetts Electric issues are active and strong. The preferred is unchanged at 97, but the common is up ¾ to 37¾. Profit-taking caused some recession in United Railways, of Baltimore, during the week, the common dropping from 16⅞ to 16⅜, and the income bonds from 71¾ to 71. Other Baltimore sales include United Railway 4s at 94⅝, Atlanta Railway 5s at 106¾, Newport News 5s at 106 and 107, Lexington Railway 5s at 102½, Norfolk Railway 5s at 111, Knoxville Traction 5s at 99, and Nashville Railway 5 per cent certificates at 65⅞. North Jersey Street Railway stock is quoted 2 points higher at 30 by leading New York specialists. The favorable annual report of the system has already been referred to in the Philadelphia article. Syracuse Transit is lower at 20 bid for the common and 60 bid for the preferred. Columbus and Louisville local securities are unchanged, and New Orleans City Railroad shares made no response to the formal announcement that the road had been sold to the eastern syndicate, which has organized a new company under the laws of New Jersey. North American has had a further remarkable advance on the New York Stock Exchange, but the movement continues to be referred to simple manipulation by a speculative clique. San Francisco securities on the New York

curb have maintained a large degree of activity with some improvement in prices. The common stock is up a point to 23⅝, the preferred has risen to 62, the bonds to 89¾, and the subscription privileges to 102¼. Traction stocks were unusually quiet on the Cleveland Exchange. The only sales were about 200 shares of Big Consolidated and 100 of Northern Ohio Traction common, both at stationary figures. There were numerous offers but few bidders. Monday 100 Northern Ohio common sold at 34.

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 March 18	March 26
American Railways Company	†43	†43
Boston Elevated	169	167
Brooklyn R. T.	a66⅞	65¼
Chicago City	*223	223
Chicago Union Tr. (common	17½	19¼
Chicago Union Tr. (preferred)	54	56
Cleveland City	105	..
Cleveland & Eastern	a30	a30
Cleveland Electric	84¾	83½
Columbus (common)	51½	54
Columbus (preferred)	102	102
Consolidated Traction of N. J.	70	70
Consolidated Traction of N. J 5s	110¼	110½
Consolidated Traction of Pittsburgh (common)	24⅛	24½
Consolidated Traction of Pittsburgh (preferred)	64½	..
Detroit United	68	67
Electric-People's Traction (Philadelphia) 4s	98	98¼
Elgin, Aurora & Southern	34	34
Indianapolis Street Railway 4s	85	†85
Lake Street Elevated	11	12½
Manhattan Ry.	134¼	133½
Massachusetts Elec. Cos. (common)	36½	37
Massachusetts Elec. Cos. (preferred)	96¾	96½
Metropolitan Elevated, Chicago (common)	41½	41
Metropoliton Elevated, Chicago	90	91
Metropolitan Street	168¼	167½
New Orleans (common)	30½	30½
New Orleans (preferred)	105	104¾
North American	118	124½
Northern Ohio Traction (common)	33½	35
Northern Ohio Traction (preferred)	85½	a87½
North Jersey	28	30
Northwestern Elevated, Chicago (common)	38	39
Northwestern Elevated, Chicago (preferred)	86	86
Philadelphia Traction	98	97¾
St. Louis Transit Co. (common)	29	30¼
South Side Elevated (Chicago)	112	a115
Southern Ohio Traction	..	a60
Syracuse (common)	21	20
Syracuse (preferred)	61	60
Third Ave.	130	130
Twin City, Mineapolis (common)	115	114¾
United Railways, St. Louis (preferred)	84¾	85
United Railways, St. Louis, 4s	88¾	89
Union Traction (Philadelphia)	39¾	40

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

Iron and Steel

The rise in iron and steel prices continues in spite of every effort of the leading producing interests to stem the tide. It is only fair to emphasize the fact, however, that the high premiums are being paid simply where immediate delivery is sought; and this represents only an insignificant part of the country's business. The great bulk of the orders in foundry and Bessemer pig iron now being filled represent old contracts placed at the moderate prices prevailing up to two months ago. Imports of the foreign product have, for the time being, been checked by the sharp rise in the foreign markets. Nevertheless, the best-informed people assert that there is no danger of a really serious scarcity, that production only slightly exceeds consumption, and that the present abnormally low condition of the supplies on hand is not likely to last for very much longer. Quotations are $17.50 for Bessemer pig, $31 for billets, and $28 for rails.

Metals.

Quotations for the leading metals are as follows: Copper, lake, 12¼ cents; tin, 26.10 cents; lead, 4⅛ cents, and spelter, 4.35 cents.

LOS ANGELES, CAL.—On March 21 the local papers said: "It is stated on good authority that United States Senator Clark has acquired control of the Los Angeles Traction Company, the only street railway system in this city in competition with the Huntington lines. Thomas E. Gibbon, general counsel for San Pedro, Los Angeles & Salt Lake Road, has returned from Washington, where, it is said, he completed arrangements for the transfer of the traction property to Senator Clark. No details of the deal have been given out, but Mr. Gibbon admitted that Senator Clark is now interested in the Traction Company, and that as soon as the necessary franchises shall be obtained the system will be enlarged."

DENVER, COL.—The Denver City Tramway Company reports earnings as follows:

February	1902	1901
Gross receipts	$112,666	$98,403
Operating expenses	64,769	56,596
Earnings from operation	$47,897	$41,807
Fixed charges	32,621	31,642
Net earnings	$15,276	$10,165
From Jan. 1 to Feb. 28		
Gross receipts	$232,368	$206,814
Operating expenses	129,052	113,487
Earnings from operation	$103,316	$92,327
Fixed charges	65,647	63.013
Net earnings	$37,669	$30,314

ATLANTA, GA.—The Georgia Railway & Electric Company will, it is stated, assume formal possession of the properties of the Atlanta Railway & Power Company, the Atlanta Rapid Transit Company, the Georgia Electric Light Company, and the Atlanta Steam Heating Company on April 1. The company will be capitalized at $6,800,000, and bonds to the amount of $11,000,000 will be issued. Of the capital stock, $1,800,000 will be 5 per cent preferred and $5,000,000 will be common. The bonds will be secured by a first mortgage covering the several properties. They will be dated April 1, 1902, bear interest at the rate of 5 per cent, and will fall due on April 1, 1932. Provision is made for their retirement at 110 after Jan. 1, 1907. The Old Colony Trust Company is trustee of the mortgage. The plan of the company is to retire $2,500,000 bonds of the Atlanta Railway & Power Company, also $1,250,000 bonds of the Atlanta Rapid Transit Company. There are to be held in escrow $1,250,000 bonds to retire a like amount of Georgia Light & Power Company's bonds, and $2,500,000 bonds are to be held in escrow to retire a like amount of Atlanta Consolidated Street Railway Company bonds. The company is to set aside $250,000 for its own purposes, evidently for improvement. The remaining $3,150,000 are to be issued only as provided for in the mortgage deed.

DES MOINES, IA.—The Interurban Railway Company has filed for record a trust deed for $47,000 in favor of the American Trust & Savings Bank, of Chicago. The deed is to cover an issue of $475,000 5 per cent bonds of the denomination of $1,000 each, dated April 1, 1901, to run for twenty years. The bonds are given for the purpose of securing capital to construct the extension from Des Moines through Altoona, Mitchellville and Colfax to Newton.

COVINGTON, KY.—Stock of the Cincinnati, Newport & Covington Railway Company and the Union Heat, Light & Power Company which is to be exchanged for stock of the Cincinnati, Newport & Covington Light & Traction Company, formed as a stockholding company to take over the two companies mentioned above, is to be deposited by May 15, 1902, with the Cincinnati Trust Company. As previously stated, the Cincinnati, Newport & Covington Light & Traction Company was incorporated on March 11 with $10,000,000 authorized capital stock, of which $5,000,000 is 4½ per cent non-cumulative preferred. The Cincinnati, Newport & Covington Light & Traction Company will issue and deliver $4,300,000 preferred and $5,000,000 common stock in payment for the stocks of the companies and $500,000 in cash, to be used by the new company to provide for improvements and extensions. The remaining $700,000 of preferred stock will be held for future developments and requirements. Stockholders who do not desire to exchange their stock are offered $100 in cash for each share of stock held.

BOSTON, MASS.—The Senate has passed the bill authorizing the Railroad Commissioners when approving the issue of stock and bonds for additional locations for street railway companies to take into consideration only the extensions and not require them to appraise the whole road.

WORCESTER, Mass.—The Worcester Railway & Investment Company, which holds the stock of the Worcester Consolidated Street Railway Company and the Quinsigamond Park Company, has voted to increase its capital stock from $6,000,000 to $7,000,000.

RED BANK, N. J.—It is stated that over 70 per cent of the bonds of the Atlantic Coast Electric Railway Company has been deposited with the reorganization committee under terms of an agreement dated Nov. 25, 1901. It is said that the sale of the property will probably be arranged in the next few weeks.

BROOKLYN, N. Y.—The stockholders of the Brooklyn Rapid Transit Company, at a special meeting, held on March 20, voted to authorize the new mortgage for $150,000,000. The bonds, as stated in the STREET RAILWAY JOURNAL for Feb. 22, are to be used to retire outstanding bonds, and for improvements. A rather unexpected feature of the bonds, which was brought out and carried, was to make the bonds convertible into stock within two years, and after not more than twelve years subsequent to their issue.

NEW YORK, N. Y.—The Metropolitan Street Railway Company has declared the regular quarterly dividend of 1¾ per cent, payable April 15, to stock of record March 31.

NEW YORK, N. Y.—The Railroad Commissioners have approved the application of the Metropolitan Street Railway for consent to issue its refunding mortgage for $65,000,000. Of the bonds to be issued under the mortgage $54,000,000 will be for refunding other issues and $11,000,000 for equipping with underground electricity the lines now propelled by horsepower.

CLEVELAND, OHIO.—The Cleveland Electric Railway Company has declared the regular 1 per cent quarterly dividend, payable April 5.

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., Feb. '02	41,643	27,531	14,112	12,500	1,612
	1 " " '01	35,348	22,253	13,095	10,417	2,679
	2 " " '02	89,930	56,715	33,215	------	------
	2 " " '01	80,979	53,985	26,994	------	------
	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.	2 m., Feb. '02	231 685	171,635	60,040	45,750	14,290
	2 " " '01	206,231	149.997	57,234	39,802	16,432
	8 " " '02	983,047	670,108	312,990	168,767	144,223
	8 " " '01	919,994	624,080	295,914	159,631	136,282
AUGUSTA, GA.						
Augusta Ry.& Elec.Co.	1 m., Oct. '01	18,031	10,012	8,019	------	------
	1 " " '00	15,772	9,668	6,104	------	------
	10 " " '91	169,950	102,279	67,671	------	------
	10 " " '00	157,049	91,785	65,264	------	------
BINGHAMTON, N. Y.						
Binghamton St. Ry. Co.	1 m., Feb. '02	12,451	9,421	3,030	------	------
	1 " " '01	12,358	8,538	3,820	------	------
	8 " " '02	77,851	44,928	32,923	------	------
	8 " " '01	70,766	39,614	31,151	------	------
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., Dec. '01	1,035,525	* 753,512	282,013	------	------
	1 " " '00	978,026	* 672,568	305,459	------	------
	6 " " '01	6,534,045	*4515871	2,018.174	------	------
	6 " " '00	6,137,956	*3902052	2,235,905	------	------
	12 " June '01	12,135,559	*7216008	4,919,551	1,341,748	577,803
	12 " " '00	11,768,550	*7106373	4,662,177	4,135,405	526,772
BUFFALO, N. Y.						
International Tr. Co.	1 m., Jan. '02	256,595	152,660	103,934	98,014	5,921
	1 " " '01	239,182	123,257	115,925	85,402	30,522
	7 " " '02	3,288,747	1,531,365	1,757,382	694,848	1,062,534
	7 " " '01	1,763,029	854,046	908,983	565,446	343,537
CHICAGO, ILL.						
Chicago & Milwaukee Elec. Ry. Co.	1 m., Feb. '02	9,552	5,646	3,876	------	------
	1 " " '01	6,731	5,584	1,147	------	------
	2 " " '02	20,476	11,520	8,957	------	------
	2 " " '01	14,963	11,223	3,740	------	------
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	191,172
	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., Feb. '02	16,253	12,418	3,835	------	------
	1 " " '01	14,421	12,217	2,204	------	------
	2 " " '02	35,013	25,400	9,613	------	------
	2 " " '01	29,604	23,037	6,567	------	------
	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., Feb. '02	8,918	5,893	3,025	6,258	+ 3,234
	1 " " '01	7,807	4,926	2,881	6,042	+ 3,161
	2 " " '02	19,119	12,314	6,805	------	------
	2 " " '01	16,841	10,363	6,478	------	------
	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., Feb. '02	112,666	64,769	47,897	32,621	15,275
	1 " " '01	98,403	56,596	41,806	31,642	10,164
	2 " " '02	232,308	129,053	103,316	65,647	37,669
	2 " " '01	206,814	113,487	93,327	63,013	30,314
	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 & Port Huron Shore Line	1 m., Nov. '01	27,979	17,447	10,532	9,466	1,066
	1 " " '00	25,039	16,921	8,118	9,692	------
	11 " " '01	355,195	206,052	149,143	106,163	42,980
	11 " " '00	262,800	151,503	111,297	71,623	39,674
Detroit United Ry.	1 m., Feb. '02	230,917	135,056	95,861	64,785	31,076
	1 " " '01	199,776	115,281	84,496	57,360	27,135
	2 " " '02	486,943	282,780	204,163	128,944	75,220
	2 " " '01	420,383	240,701	179,682	114,704	64,977
	12 " " '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
Rapid Ry.	1 m., Dec. '01	30,984	* 17,678	13,306	9,692	3,614
	1 " " '00	27,873	* 18,735	9,138	9,692	+ 554
	12 " " '01	386,624	* 223,730	162,894	116,300	46,954
	12 " " '00	290,673	* 170,237	120,436	81,315	39,121
DULUTH, MINN.						
Duluth-Superior Tr.	1 m., Feb. '02	33,419	20,780	12,639	9,563	3,077
	1 " " '01	29,303	18,895	10,408	9,064	1,344
	2 " " '02	70,121	43,939	26,182	19,228	6,954
	2 " " '01	61,551	38,385	23,166	18,180	4,986
ELGIN, ILL.						
Elgin, Aurora & Southern Tr.	1 m., Feb. '02	28,216	17,954	10,262	8,333	1,928
	1 " " '01	24,519	17,513	7,006	8,333	+ 1,327
	9 " " '02	283,940	156,931	127,009	75,000	52,009
	9 " " '01	246,662	158,186	88,476	75,000	13,476
HAMILTON, O.						
Southern Ohio Tr. Co.	1 m., Feb. '02	21,050	14,436	6,614	7,500	+ 886
	1 " " '01	18,352	13,155	5,198	7,500	+ 2,302
	12 " Dec. '01	337,741	182,954	154,787	90,000	64,787
	12 " " '00	294,907	154,465	140,542	90,000	50,542
LONDON, ONT.						
London St. Ry. Co.	1 m., Feb. '02	8,895	6,558	2,336	1,999	338
	1 " " '01	8,146	5,973	2,173	1,740	432
	2 " " '02	19,012	13,637	5,375	4,248	1,128
	2 " " '01	17,402	12,574	4,828	3,777	1,051
MILWAUKEE, WIS.						
Milwaukee El. Ry. & Lt.	1 m., Feb. '02	195,974	94,527	101,447	62,693	38,754
	1 " " '01	169,183	95,080	74,103	58,359	15,745
	2 " Feb. '02	410,858	201,059	209,799	128,094	81,704
	2 " " 01	355,992	201,515	154.477	119,660	34,817
MINNEAPOLIS, MINN.						
Twin City R. T. Co.	1 m. Feb. '02	244,781	120,271	124,509	58,516	65,993
	1 " " '01	215,580	106,461	109,117	52,698	56,419
	2 " " '02	516,939	252,691	264,247	117.033	147,214
	2 " " '01	451,854	221,685	230,168	106,028	124,140
MONTREAL, CAN.						
Montreal St. Ry. Co.	1 m., Feb. '02	133,645	103,915	29,729	14,581	15,149
	1 " " '01	127,612	87,654	39,958	8,774	31,184
	5 " " '02	767,844	491,761	276,082	74,211	201,872
	5 " " '01	726,527	461,276	265,251	45,814	219,438
NEW YORK CITY.						
Manhattan Ry. Co.	3 m., Dec. '01	3,088,435	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., Nov. '01	4,200	2,044	2,156	1,146	1,010
	1 " " '00	3,934	2,392	1,541	1,597	------
	5 " " '01	25,876	11.077	14,799	7,160	7,640
	5 " " '00	23,837	11,005	12,852	7,276	5,555
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., Feb. '02	70,615	------	------	------	------
	1 " " '01	58,058	------	------	------	------
	2 " " '02	650,561	------	------	------	------
	2 " " '01	561,994	------	------	------	------
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., Feb. '02	81,934	48,866	33.068	24,672	8,396
	1 " " '01	75,949	51,074	24,875	24,172	703
	2 " " '02	172,900	99,464	73,436	49,520	23,916
	2 " " '01	158,980	106,295	52,685	48,416	4,269
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., Feb. '02	52,901	30,775	22,126	19,025	3,101
	1 " " '01	47,676	26,540	21,136	18,588	2,548
	8 " " '02	458,390	251.952	206,439	152,146	54,293
	8 " " '01	404,872	222,231	182,641	148,928	33,714
TOLEDO, O.						
Toledo Ry. & Lt. Co.	1 m., Feb. '02	99,450	52,523	47,427	37,833	9,593
	1 " " '01	89,079	44,962	44,116	24,271	19,846
	12 " " '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 El	1 m., Dec. '01	15,080	11,916	3,163	8,559	df.15,396
	1 " " '00	13,177	11.237	1,940	8,333	†6,394
	6 " " '01	125,977	88,229	37,749	52,774	†15,025
	6 " " '00	120,277	76,395	43,882	52,348	† 8,466