STREET RAILWAY JOURNAL

SATURDAY, DECEMBER 20, 1902

PUBLISHED WEEKLY BY
THE STREET RAILWAY PUBLISHING COMPANY
MAIN OFFICE:
NEW YORK, ENGINEERING BUILDING, 114 LIBERTY STREET.

BRANCH OFFICES:
CHICAGO ..... Monadnock Block
PHILADELPHIA ..... 929 Chestnut Street
CLEVELAND ..... Cuyahoga Building
LONDON ..... Hastings House, Norfolk Street, Strand

Correspondents in other Principal Cities of the World.
Long Distance Telephone, "New York, 4044 Cortlandt."
Cable Address, "Stryjourn, New York,"—Lieber's Code used.

TERMS OF SUBSCRIPTION.

In the United States and Canada ..... $4.00 per annum
Single copies, first issue of each month, 35 cents; other issues, 5 cents.
In all Foreign Countries, per annum ..... $6.00 / 25s / 31fr
Subscriptions payable always in advance, by check (preferred), money order or postal note, to order of C. E. WHITTLESEY, Treasurer.

Entered as second-class matter at the New York Post Office.

Contents of this Issue

Right to Regulate Transfers

The result of litigation in Baltimore involving the right of the street railway company to impose restrictions on the use of transfers is reported in detail elsewhere in this issue. The company was sustained in its position, and the rulings of the trial judge, as well as the verdict of the jury, will be generally commended by unprejudiced observers. One point which was very clearly established in this proceeding was that the company could impose a time limit on the use of transfers, which effectually disposes of the theory that a transfer may be used as a stop-over privilege and the holder take advantage of it to do shopping or transact other business. This is the practice in many places, and in others it has been customary to use the transfers at any time on the day they were issued. This naturally has a tendency to encourage trading in transfers, and results in serious loss to the company.

In the Baltimore litigation the court ruled that the transfer was conclusive evidence between the passenger and the conductor as to the passenger's right to ride. The transfer was stamped "Not good after hour punched in the margin," and the time limit thus fixed had expired. Therefore as the transfer was bad on its face, the conductor had the right to demand that the passenger pay his fare or get off the car, and in the event of his refusal he had the right to use all reasonable and necessary force to expel him. It was further contended that as the transfer was conclusive evidence between the passenger and the conductor, if there had been any error by an agent of the company by which the passenger had been injuriously affected, the latter's rights were in action for breach of contract. It was the duty of the passenger, under the circumstances, to pay his fare, postpone his claim, and not compel the conductor to eject him. Any other ruling, it was pointed out, would either compel a conductor to accept the word of every passenger who had a transfer that was bad upon its face, and thus open the door to continuous frauds, or else eject every passenger who had a bad transfer and refused either to pay or leave the car. This view is both reasonable and just, and it will undoubtedly command the approval of fair-minded men.

Efficient Discipline

One of the striking developments in railway work during the last decade has been the introduction of system and method in the discipline of employees. In the early days of railroading, both street and steam, the relations between the employees of the company and the superintendent or manager were similar to those in a small company in any industry. That is, the man in charge was a sort of Czar, whose government was sometimes very fair, but more often was characterized by rulings which were both arbitrary and erratic. The idea of the introduction of system, except in a most general way, was considered impossible in a department in which so many human elements entered as in that of discipline. Matters have changed, however, on both steam and street railroads, and the most thoughtful managers in both branches of the work are those who give closest attention to this subject, as the articles published in this paper recently and the discussions before bodies of street and steam railroad men testify.

Properly to understand the most accepted views on discipline, however, the word itself should be divorced from the common, though incorrect, meaning which has often attached to it, and which makes it synonymous with punishment. Discipline means instruction as well as correction, and the object of efficient discipline should be to teach the correct way quite as much, if not more, than to punish those who do not comply with the rules of a company. The subject, broadly speaking, divides itself into three parts; first, the establishment of the best rules for the government of employees; second, the enforcement of such rules by the employees, both in their spirit and in their letter; and third, the disposition of the cases of those men who do not comply with the regulations of the company. Each of these subjects is worthy of exhaustive study, and it is hard to say which is the most important, although the third has perhaps been given more atten-

tion in the papers read on this topic at the meetings of the different associations, and is the one to which most of the speakers at the recent meeting of the New York Railroad Club devoted their attention.

It is a very significant fact that all of the seven speakers on this subject at the recent meeting of the New York Railroad Club, and whose remarks have been published in these columns, advocated a broad and sympathetic policy of treatment in the government of employees. Much has been written on this subject from the moral standpoint, but we consider it a very significant fact when seven speakers, representing practically as many important transportation corporations, argue the same policy as best serving the commercial interests of the company. If this sort of thing is continued, the business of the walking delegate and others whose function in life it is to foment discord between employer and employee will be gone. We do not mean to say that the millenium has come, or that there will not be points of difference between the managers and the working force of the future transportation companies. But if the employee meets the management upon anywhere the same basis in favor of fair dealing which prominent managers now advocate in their relations to him, such differences as do exist should be so slight that they can be removed without serious friction.

Possibility of an International Street Railway Congress

Elsewhere the announcement is made of a proposed plan of the directors of the St. Louis World's Fair to hold a series of world's congresses during the Exposition in 1904, and we sincerely trust that arrangement will be made for the inclusion in the subjects to be discussed of electric railway topics. Congresses of this general kind have been held at the last two or three international fairs, but it is only within the last few years that the electrical railway industry has grown to such proportions that its importance has warranted a demand for a conference of this kind.

The first, in fact the only, international street railway congress which has ever been held at a World's Fair, was in 1900, at the time of the Paris Exposition. At this congress four days were set aside for the discussion of topics connected with street railway work, and the proceedings, which were reported in the Street Railway Journal, indicated that a great deal of interest was taken in the movement. Official delegates were sent by the principal European governments to attend and take part in the meetings and to report as to the improvements brought out at the meeting and on any other points in which the governmental authorities would be interested. The president of the congress was L. Janssen, president of the International Street Railway Association.

A world's congress on electric railway matters, however, without the active participation of American engineers, is like the play of Hamlet with Hamlet left out. On the other hand, the leading position of this country in all matters pertaining to transportation by electric power would insure the success of a world's fair congress on electric railway matters if held in this country, and if given the active participation of a body like the American Street Railway Association. We believe that a meeting of this kind would also be attended by a large number of foreign delegates if invitations were extended to them in an official way. In the first place, it is reasonably certain that all of the Continental governments who make a practice of sending official representatives to all meetings of the International Street Railway Association, would follow a similar course in the case of an international congress held in this country. It is also reasonably certain that many, if not all, of the various street railway associations in Europe would be represented and the congress would be as well attended by many independent engineers and investigators. The paramount position of this country in electrical railway development has been the means of bringing to this country during the last five or six years, as most of our readers know, many electrical engineers who have made a tour of inspection of the principal lines, and an occasion of this kind would form an additional reason for such a trip. It is needless to say, therefore, that such a congress would bring forth results of international importance, which would only be possible for a convention held on American soil.

The Snow Problem

This is the strenuous season in which the street railway manager, especially of suburban roads, reads the weather reports more in sorrow than in anger, and buckles down to hard work. When the community depends, as it now does, mainly on electric cars for getting about its business, the maintenance of service in spite of the weather is a matter of fundamental importance. The growth of street railways has done a splendid work in increasing the mean radius of urban population, but this very fact makes complete continuity of service doubly important. A heavy snowstorm has now become a far more serious matter than it once was, and it must be dealt with actively and continuously. The work varies widely in character, according to local conditions, but it may be divided broadly into preventive and curative measures, differing radically in relative importance as the road involved is strictly urban or largely suburban. In either case, however, there is trouble enough and to spare. On urban systems the main work must of necessity be preventive, for once delays begin they accumulate with frightful rapidity and coalesce into blockades of a disastrous character. The only remedy is to keep the tracks clear in an operative sense from the very start. There is little leeway in the schedules, and whatever is done must be done promptly. Once let the snow get a start and all is lost. The usual resort is to working cars equipped with shear or nose plows and sent over the lines as frequently as possible. As soon as snow starts out come the plows, and if the manager is really alert the plow crews are kept at call whenever snow is predicted or probable. Under favorable circumstances this procedure works well, but we wish here to call attention to its weak point.

It is this—that the plows must be sent over the line between cars, and the number of plows being limited it is exceedingly easy to get one after another put out of service behind a stalled car. We have then all the elements of a severe blockade, and trouble ensues at once. So long as a car can keep going, the following plow can clear the way well for the cars beind, but at the first stop the procession stops too. It seems to us, therefore, that there is room for great development in the line of track-clearing devices on the individual cars. Such there are, and they do pretty good work, but not quite well enough, and the problem of applying them deserves thorough study. If every car that runs after the snowfall begins is equipped to make its own way it takes a very formidable storm to cause a blockade. Of course such devices are not equal to the regular plows, and may fail in a bad storm, but they make up by their number on an urban system for lack of individual power, and will keep the track open for traffic in cases where the regular plows would fail. It is the clearing power per minute of storm that counts, rather than the capacity of the plows that might be in action if they could reach the obstruction. On lines where the cars are frequent the individual plowing devices count for the most, and the heavier apparatus can be put into full action only after the mischief has been done. Aside from this their best work is in keeping the track clear during the hours when few regular cars are running. Once a procession of cars is stopped it is a question of shovels to get it started, with every minute of delay rendering the task more difficult.

On suburban lines, running comparatively few cars, troubles increase. If the snow is falling heavily it may pile up too fast for the clearing devices of individual cars to deal with it, but with the looser schedule there is more chance for a car to work its way to a point where a plow can get in ahead of it and clear the way. In any case, however, the capacity of each individual car for pushing its way is a most important element in the game that must not be neglected. The regular shear or shovel plows will do admirable work in storms of moderate severity, but on long lines

through open country the drifts will often get a start that puts ordinary apparatus out of action. In such an exigency the rotary plow is the last word in the controversy. The steam railroads of the country have threshed out the snow question through years of toilsome and costly experience and have settled pretty firmly on the rotary plow as the most efficient weapon. Not only will it bite its way through prodigious drifts, but it will rip through any ordinary snows fast enough to open track almost on schedule time. Of course a rotary plow is a costly machine and uses a very large amount of power, a point which should be kept in mind in laying out the feeders for country lines, but it does the work and ought not to be left out of the equipment of any road that has to contend with severe snowstorms. The ordinary plows are most useful machines, and do all that can be reasonably expected of them, but they cannot do everything, even if they can get into action, or anything if they get caught in a procession. It is for this reason that the snow-fighting equipments of the individual cars should receive more attention than is usually given them. Snow-fighting is a costly business at best, and there has to be enough shovelling anyway, without doing more of it than is absolutely necessary. The less such labor has to be supplied the better, and we think that the cheapest course in the long run is to be very liberal with the mechanical equipment of the system, and to make each car as far as practicable independent of outside help. And when worst comes to worst it will not take many hard storms to pay for a rotary plow of the most efficient description.

The Brooklyn Bridge Traffic Problem

For the relief of the present traffic congestion on the Brooklyn Bridge, the Brooklyn Rapid Transit Company has recently been authorized to install four additional loops at the New York terminal. The decision that this would provide the best form of temporary relief was reached by a committee of experts appointed by the Mayor. Contracts have been let, and as soon as possible the work will be begun with prospect of its completion early in the coming spring.

It is interesting at this time to consider what measure of relief will be afforded by the installation of the four additional loops. As is well known, the annoyance and inconvenience arising from the terribly overcrowded condition of the New York terminal at the rush hour is owing largely to the concentration of an immense traffic in the narrow space occupied by the four existing loops used by the surface lines. To scatter this concentration over a much larger terminal area is the object sought in the new plan. That it will aid greatly in doing this can hardly be questioned, as it will enable the cars of the seventeen different lines to be distributed over the terminal with regard to territorial assignement. In other words, all cars for the South Brooklyn section may be assigned to one place; those for the Eastern (or Williamsburg) District grouped in another place, etc. By so doing the streams of traffic going to the different sections of the city will not be brought into such close contact with one another. Moreover the cars may be permitted to stand longer, instead of being pushed out, as at present, by the necessity of making room for the following cars. All of this will add greatly to the convenience and comfort of the patrons of the road, and will make it possible for men and women to get through the crush without having their buttons torn off.

But will it do anything more than this toward the relief of the traffic congestion itself? It would seem that the really important question is whether it will enable any more cars to be run over the bridge at the time of maximum traffic. To subserve the comfort and convenience of the passengers in boarding and alighting from the cars in the New York terminal by scattering the masses of people over a larger area is one thing, but to move them faster and with more comfort on the cars is quite another thing. To increase the length of the platforms on the Manhattan Elevated Road, as is now being done, will certainly add to the convenience and comfort of the people waiting at stations for trains, but unless more cars are run at the time of maximum load the same old crush will be unavoidable on the trains. The object in increasing the length of the platforms is to enable the handling of six cars per train, instead of five, thereby increasing the traffic carrying capacity by one-fifth. But it is not as yet clear how the four additional loops are going to enable the running of more surface cars over the bridge.

Those who are familiar with the bridge operation know that the capacity of the single track on each roadway is not limited by the existing four loops at the New York terminal, but by other and more difficult considerations. Sands Street on the Brooklyn side may be likened to the neck of the bottle at which all the streams of traffic converge, and through which they must flow. As previously stated, there are seventeen different lines of surface cars reaching the bridge through three or four avenues, which, at or near Sands Street, must pass on to a single track before entering on the north roadway of the bridge. Under the present arrangement nine of these lines, comprising about half of the cars operated over the bridge, must, upon their return from New York, cross at grade at the Brooklyn entrance at or near Sands Street the entire traffic of seventeen lines going toward New York. At the same point on Sands Street where the car traffic crosses itself a large portion of the vehicle traffic coming from New York crosses the vehicle and car traffic going toward New York. This narrow space where both car and vehicle traffic crosses itself will, until something is done, fix the limit upon the number of cars that can be operated. President Greatsinger's plan for elevating the New York bound track and carrying it on a level with the bridge floor over Sands Street, if he is permitted by the city and bridge authorities to carry it into effect, will effectually remedy the difficulty at that point, but will they let him do it?

With that difficulty removed there still remains another which is perhaps equally as serious. The cars and vehicles on the bridge occupy jointly the narrow space of a single roadway. The speed of the cars is limited by that of the vehicles. The latter, for some unaccountable reason, are not restricted to a certain space, but have the liberty of the entire roadway, dodging in between the cars here and there, oftentimes effectually blocking their progress. The cars, under all circumstances, are expected to keep a distance of 102 ft. apart, which is an invitation to the drivers to run in front of and between them.

The unfortunate feature of the whole situation is that the maximum vehicle traffic comes at the same time as the maximum car traffic. The vehicle traffic is increasing almost in the same proportion as the passenger traffic, and as there seems to be no disposition on the part of the city authorities to regulate the volume or the movements of the vehicle traffic, the interference from it will gradually become more pronounced. When the bridge was first opened to the cars of the surface lines it was possible, in the rush hours, to pass 300 cars per hour through the New York terminal, and the number often ran up to 310 or 315 per hour. The most that can be done at the present time, as the reports of the operation indicate, is 270 to 280 cars, and occasionally a maximum of 290. The decrease may be ascribed almost solely to the interference of the vehicle traffic on the bridge and at the Brooklyn entrance. If this interference is to be permitted to go on increasing from year to year the time will soon come when 250 cars or less will be the maximum number which can be run through the terminal in an hour.

It seems, therefore, that the condition which all those interested have sooner or later to face is a constantly increasing demand for passenger transportation with a gradually increasing vehicle interference resulting in a gradual decline in the number of cars operated. This condition, it is needless to say, will not be remedied by the addition of four loops, or twenty loops to the surface car terminal in New York.

Equipment of the Toledo & Western Railway

Very few interurban electric railways have attracted so much attention as the Toledo & Western, which has been the subject of several articles in these columns during the last year. It will be recalled that this company is an important factor in the combination of interurban lines which maintain union passenger and freight stations at Toledo. It has developed a very efficient method of handling freight and express, as well as a heavy passenger service, and it has had experience both in competing with established steam lines and opening new territory which had never before been favored with transportation facilities. The construction and equipment of this road, which it is the purpose of this article to describe and illustrate, are consequently of great interest, not only because of the extent of the business transacted, but on account of the varied character of the service, particulars of which have been given in the Street Railway Journal of Oct. 4 and 25, and Nov. 29.

CAR SHEDS AND REPAIR SHOPS AT SYLVANIA

SIDING SHOWING OVERHEAD CONSTRUCTION AND TELEPHONE BOOTH

The company's headquarters and power house are located at Sylvania. The general offices, which have recently been removed from Toledo, together with the car house, repair shop, paint shop, club rooms for employees, train despatchers' office and stock rooms are contained in a single brick building illustrated herewith. There is space for the storage of twenty cars with pits for four cars. The machine shop is well equipped with all appliances for this class of work, as are the paint shop and armature winding department. In the men's club room are pool tables, a reading-room and a bathroom, with individual lockers.

In the construction of the road, steam practice was followed as closely as possible. The country traversed is extremely level and there are no grades over 1½ per cent, and the highest curve is 14 degs. With the exception of where the road passes through towns, 95 per cent of the mileage is private right of way ranging from 18 ft. to 35 ft. wide, the majority being the latter width. The extension to Fayette is 50 ft. wide, and future extensions will follow the same rule. All of the right of way has been purchased outright. For 6 miles running into Adrian the company purchased the abandoned right of way of the old Erie & Kalamazoo Railway, the first steam road built in the West.

TRACK AND LINE CONSTRUCTION

The track is laid with 60-lb. steel, 30 ft. and 32 ft. lengths. Ties are cedar and white oak, 6 ft. x 8 in. x 8 in., laid on 2-ft. centers. Crushed stone with 2 ins. of sand for a cushion is used for ballast. No. 10 frogs are used for switches. At towns the sidings are 400 ft. long, and those between stations, 200 ft. There are four stopping points to the mile, in addition to stations where all trains stop. The pole-line construction consists of 35-ft. cedar poles with Richmond flexible brackets and extra braces, set 90 ft. apart. Single 000 Fig. 8 trolley wire is used, with hangers of the Ohio brass type. The direct-current feeders are aluminum and copper, the former seven-strand No. 12, and the latter No. 4. The alternating-current feeders consist of three No. 4 aluminum, spaced 21 ins. apart. Porcelain insulators are used throughout, and the whole 13,000-volt construction is arranged to be changed, if required, to 26,000 volts. There are three grade crossings and two undergrade crossings. Two of the crossings are protected by derailers where the motorman must cross the track to throw the point, while the third crossing has a semi-interlocking device. There is a semaphore on the steam road and a derailer on the electric. The signal on the steam track is set at "danger" before the derailer can be opened for the electric.

CROSSING UNDER STEAM RAILROAD

ROLLING STOCK

At present the rolling stock consists of ten straight passenger coaches, two combination coaches, three express cars, three fifteen-bench open cars, twelve 60,000-lb. box cars, eight 60,000-lb.

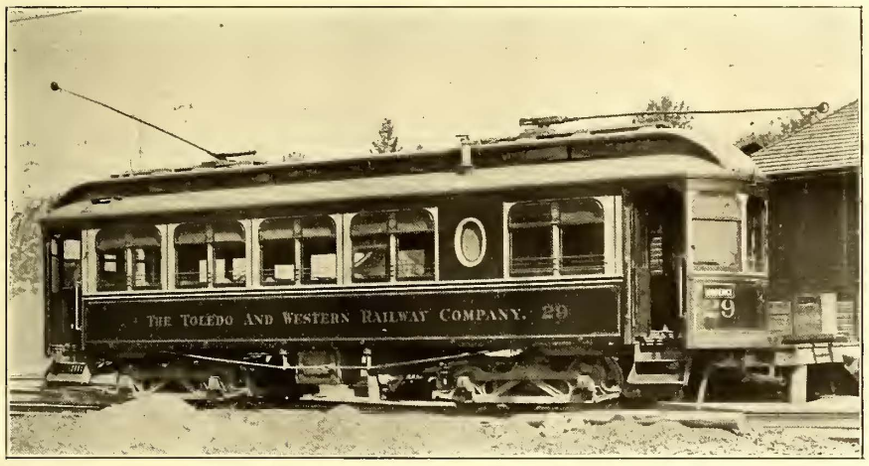
hopper bottom gondolas, twenty 60,000-lb. flat cars, three 50,000-lb. stock cars, one rotary snowplow, one inspection car, one rotary transformer car and two electric locomotives.

The passenger cars were built by the Jewett Car Company, and one of them is illustrated herewith. They are 50 ft. over all, 8½ ft. wide, and have vestibules at both ends. The passenger coaches seat fifty-four passengers and the combination cars forty-four. There are smoking compartments, toilet rooms, and ice coolers. Interior finish is cherry, and the floors are deadened by a layer of sawdust. Hale & Kilburn walk-over seats, Christensen air brakes, air sanders and air brakes and Providence fenders are used, and the cars are heated by the Peter Smith hot-water system. Power equipment consists of four 50-hp motors, about equally divided between Steel, Westinghouse and General Electric, which are mounted on Peckham 14-X high-speed trucks.

The freight cars are fitted with M. C. B. couplers, Westinghouse air brakes operated by a compressor located on the locomotive, and they have standard steam flanges and tread. These cars were built by the American Car & Foundry Company. The freight business of the road has increased to such an extent that orders have been placed which will practically double the present equipment.

The electric locomotives which have been rigged up for temporary use, are flat cars, upon which cabs have been built. They are weighted for traction, and one of them is equipped with four 50-hp motors, and the other with four 75-hp motors; the former handles four cars, and the latter seven. These cars, or locomotives, are not heavy enough to take care of the trains which the company is now desirous of handling, and an electric locomotive patterned after those used by the Baltimore & Ohio Railway at Baltimore has been constructed at the Sylvania shops. It weighs 35 tons and is equipped to handle sixteen loaded cars. The McGuire rotary snow plow is fitted with four 50-hp Steel motors for propelling the machine, and two 50-hp motors for operating the sweepers.

ELECTRIC LOCOMOTIVE BUILT IN TOLEDO AND WESTERN SHOPS

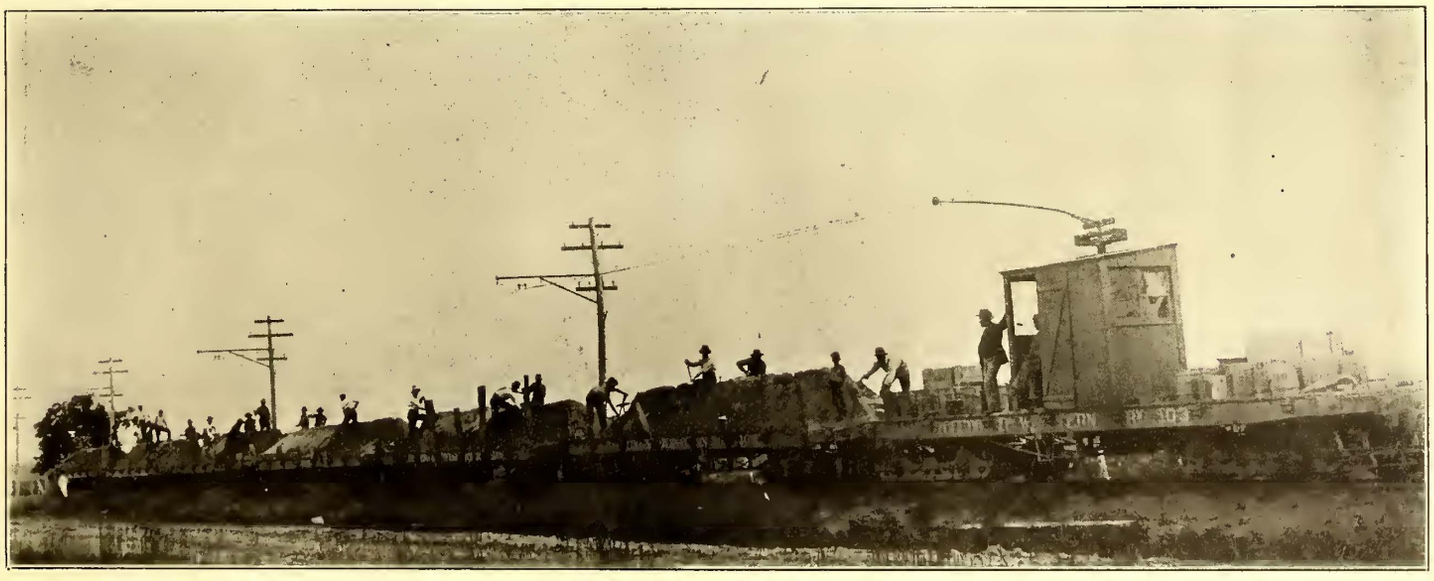


PASSENGER CAR WITH SMOKING COMPARTMENT

The inspection car before mentioned is a valuable acquisition to the rolling stock. It is a light gasolene car of the hand-car pattern, and was built by the Sheffield Car Company, Three Rivers, Mich. Two small gasolene motors mounted at the sides give the car a maximum speed of 40 miles an hour, which can be maintained all day if necessary. The operation is simple, and five passengers can be seated. The car can be lifted from the track by two men, and it has been found of great value for inspection work, permitting officials to stop off at any point without interfering with schedules.

POWER PLANT

The power plant is located on the banks of a small stream which



CONSTRUCTION TRAIN HAULED BY A "HOME MADE" ELECTRIC LOCOMOTIVE

has been dammed to form a pond, affording ample water supply of good quality. The impression given by the building is utility, rather than elegance, and the whole arrangement is such that the

MAIN POWER HOUSE AT SYLVANIA

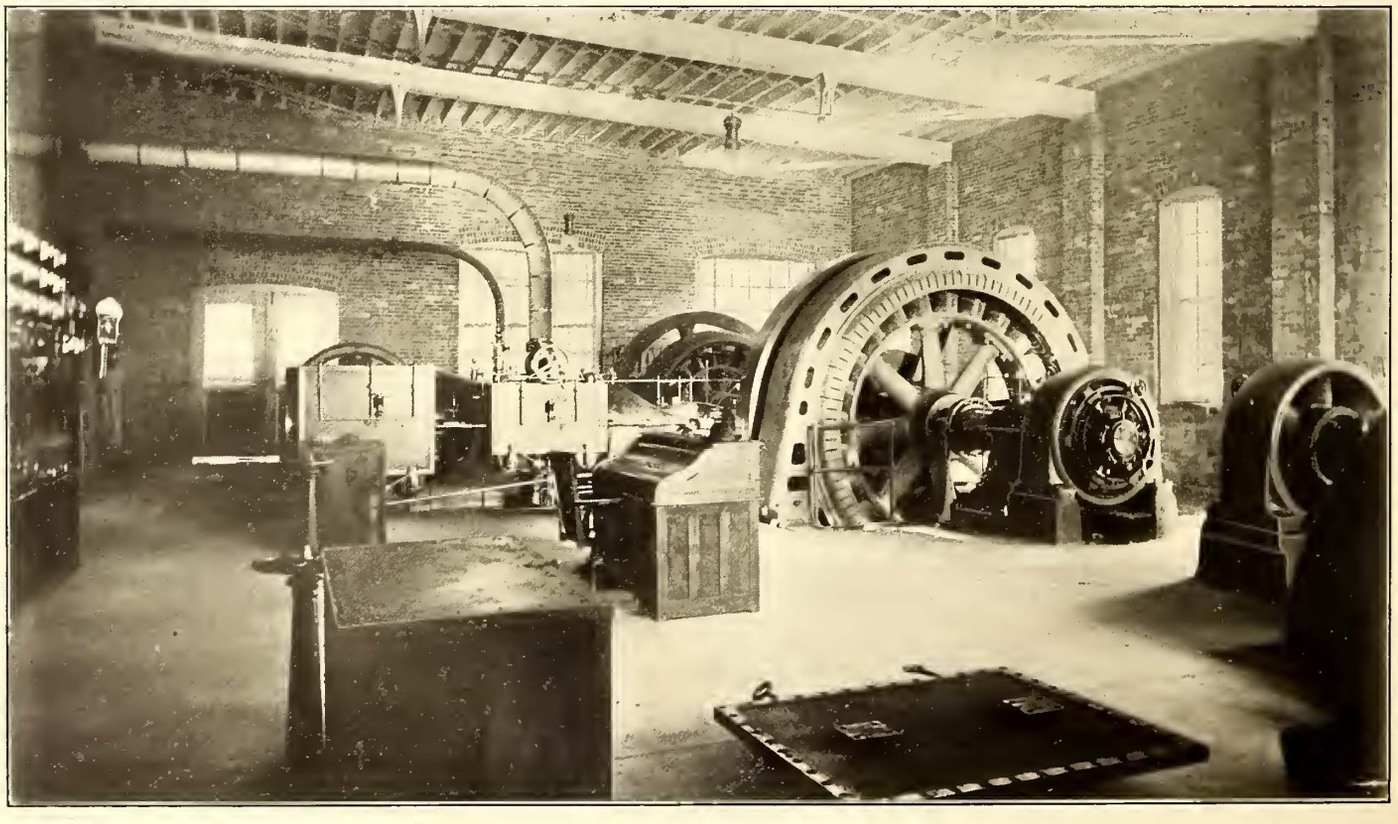
plant may be extended at any time without interfering with the part already installed, and still retain its uniformity of design. The engine room and boiler room are of the same size, 48 ft. wide by 77½ ft. long. The floor level of the boiler room is 6 ft. below that of the engine and the floor level of the engine room basement is 10 ft. below that of the engine room.

The boiler plant consists of four Stirling water-tube boilers of 300 hp capacity each, set in two batteries. The boilers are of standard design and are built with flat grates for hand firing. The stack is located between the two batteries of boilers, and is supported at the floor line on a heavy cast-iron base resting on a substantial stone foundation. The stack is 6 ft. in diameter and 125 ft. high, of heavy steel, double guyed, and is provided with an ornamental top.

Feed-water is supplied to the boilers by two Laidlow-Dunn-Gordon duplex piston pumps, set in front of the stack between the boilers. Either of these pumps is capable of supplying all the boilers, and they are cross-connected so that either can draw from the heater and feed the boilers, while the other draws from the cold-water supply and discharges to the washout and fire lines. The feed-water is heated by a Cochrane open feed-water heater placed in the rear of the stack. It receives the exhaust steam from the auxiliary steam machinery, and the piping is by-passed so that the heater may be cleaned while the plant is in operation. Water is supplied to the heater by a low duty duplex pump, placed in the engine room basement, which draws its supply either from the cold well or from the condenser overflow.

The steam header is 12 ins., and consists of two sections joined in the middle of the power house by a 10-in. U bend and valve. It is supported about 18 ft. above the boiler room floor on roller stands which allow perfect freedom from expansion. The roller stands rest on I-beams, the ends of which are imbedded in the division wall, and the rear walls of the boilers. Steam is led to the header from each boiler through two 90-deg. bends, with a high pressure valve at boiler and header. Steam for the engines is taken from the top of the header through angle gate valves and bends to the throttles. The auxiliary header, which supplies the pumps and condensers, is located under the boiler room floor, directly under the main header, in a shallow basement, 4 ft. deep, which extends the length of the boiler room, and from the rear boiler walls to the division wall. This header is drained into a trap, while both sections of the main header are drained into a receiver connected to a steam pump, which delivers the condensation to the heater.

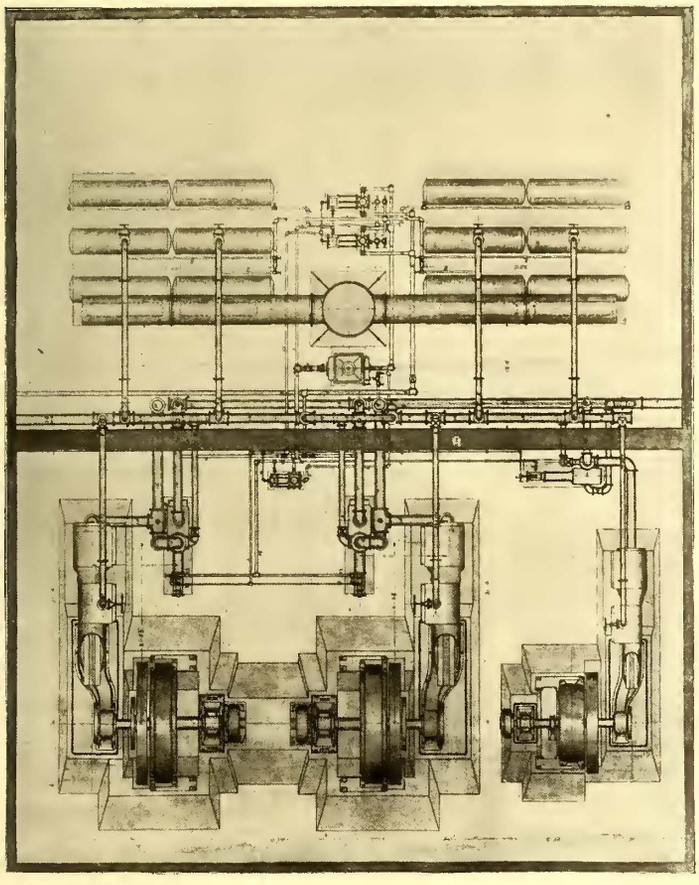
The engines, three in number, are of the four-valve tandem compound condensing type, built by the Russell Engine Company, Massillon, Ohio. Two of these have cylinders 22 ins. and 40 ins. in diameter, with 40-in. stroke, and operate at 125 r. p. m., giving a rated horse-power each of 750. The third engine is rated at 500 hp, has cylinders 18 ins. and 32 ins. in diameter, with 24-in. stroke and operates at 150 r. p. m. The steam pressure carried is 150 lbs. and the engines are guaranteed to operate continuously at 25 per cent overload. The engine shafts carry the revolving fields of the alternating-current generators between the bearings and the armatures of the exciters outside the outboard bearings.



INTERIOR OF POWER HOUSE, SHOWING TWO UNITS AND SWITCHBOARD

The engines are lubricated by a gravity system, the oil being led from an elevated tank in the boiler room to all the engines, and distributed to independent sight feed connections at each point to be lubricated. After it is used the oil passes to a filter in the engine room basement and is raised by a small steam pump to the supply tank.

For each engine there is an independent jet condenser, connected to a steam-driven, direct acting air pump. These were supplied by the Laidlow-Dunn-Gordon Company and are located in the basement of the engine room. Those for the large units are 12 ins. x 18 ins., and the one for the smaller unit is 10 ins. x 14 ins. x 18 ins. Between each engine and condenser is placed an automatic three-way exhaust relief valve, so connected that in case of a break in the vacuum, the exhaust is thrown automatically to the atmosphere, and the passage to the condenser closed, thus preventing the possibility of the water from the condenser backing up into the exhaust pipe of the engine, without the intervention of an additional gate valve. After the condenser is again started the valve may easily be thrown over to the other



LAYOUT OF POWER HOUSE

position, when the vacuum will firmly hold it. The condensers draw from a 14-in. suction line in common, and discharge also through a common line, these being located in the boiler room basement before mentioned. Pockets are provided in the discharge lines, from which the heater is supplied as before outlined.

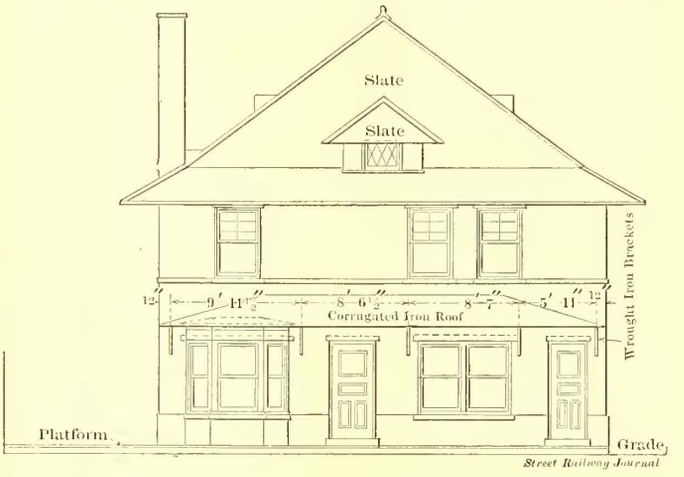
The electrical equipment consists of two 540-kw and one 360-kw revolving field type, three-phase, 25-cycle, 13,000-volt generators; two 17-kw exciters running at 125 r. p. m., and one 15-kw exciter running at 150 r. p. m., each directly connected to the shaft of its respective generator; one 360-kw rotary converter, and four 110-kw oil cooled transformers. The 13,000-volt cables running from the generators are carried directly to the oil switches in the oil switch room, which is located in the engine room directly back of the switchboard, as shown in the cut. All transformers, lightning arresters and automatic overload devices are contained in the oil switch room.

The switchboard is located about 3 ft. from the wall of the oil switch room, and only the instrument wires and the wires for operating the magnets controlling the oil switches are brought to the board. These wires are brought out in brass tubes which form a part of the switchboard construction. There are fourteen switchboard panels as follows: Three alternating-current panels, three exciter panels, four 13,000-volt feeder panels, two 600-volt direct-current feeder panels and two lighting panels for commercial lighting.

The entire electric equipment for the station was furnished by the General Electric Company, and the entire steam equipment by the Arbuckle-Ryan Company, of Toledo.

SUB-STATIONS

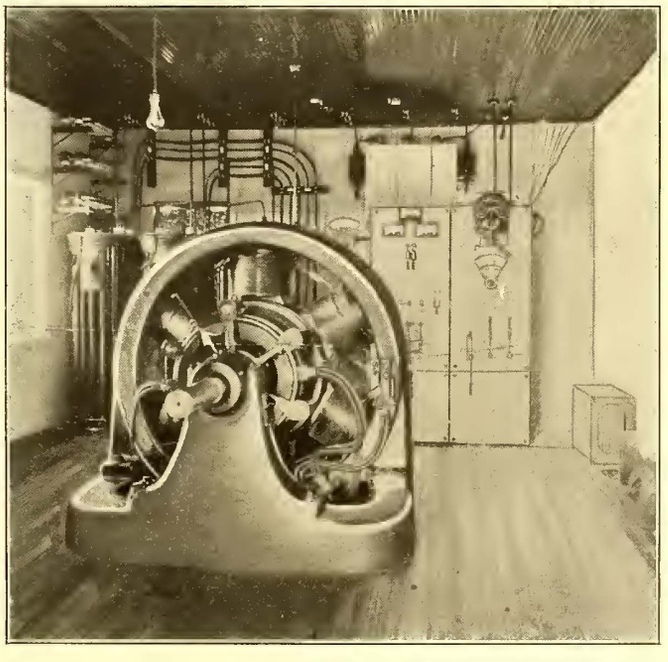
The sub-stations, of which there are six, are located at Morenci, Lyons, Metamora, Adrian, Blissfield and West Toledo, with an average distance between stations of about 10 miles. Each station contains one 360-kw rotary converter and three 110-kw oil cooled transformers, and one 35-kw reactance coil with three switchboard panels, one for the alternating current, one for direct current, and one for commercial lighting. The 13,000-volt current is controlled by oil switches which are enclosed in marble compartments, and are arranged to be operated either by automatic relay or hand controlled.



FRONT ELEVATION OF A TYPICAL SUB-STATION

The low-tension side of the transformers is arranged with an intermediate tap furnishing 185 volts, which is used for starting the rotaries, a three-pole, double switch being used to throw from low to high voltage when the rotaries are up to speed. All rotary stations are arranged with a view of supplying current for commercial lighting, as well as the operation of railway lines.

In addition to the regular sub-stations there is a portable



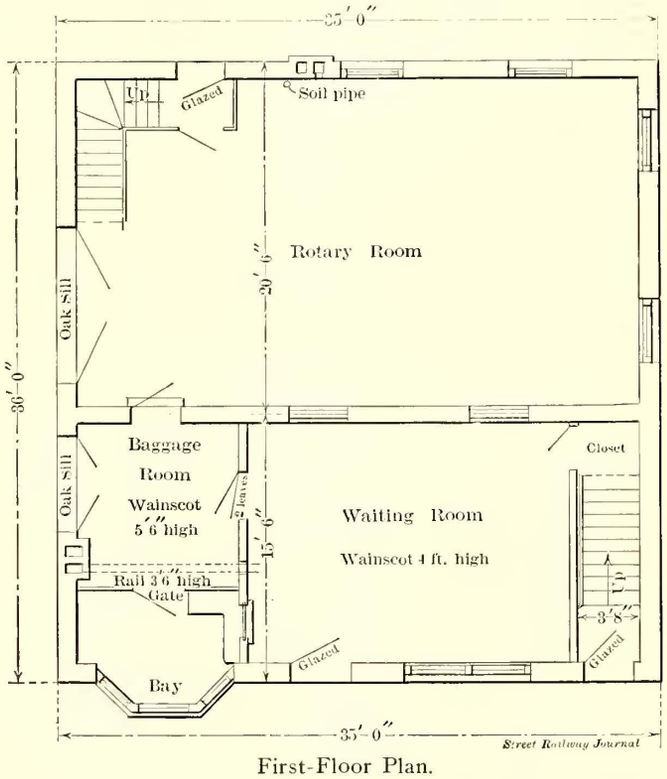
ELECTRICAL EQUIPMENT IN SUB-STATION

station, consisting of a box car equipped with one 250-kw rotary converter and three 90-kw oil cooled transformers, and the necessary switchboard and connections arranged for quick connection of both 13,000-volt and 6000-volt lines. This station is also ready for use in case of accident to any of the sub-stations, or for extra service at points where unusually heavy service is required. Under ordinary conditions this car can be connected to the line at any point, and be ready for use in less than two hours from time of starting.

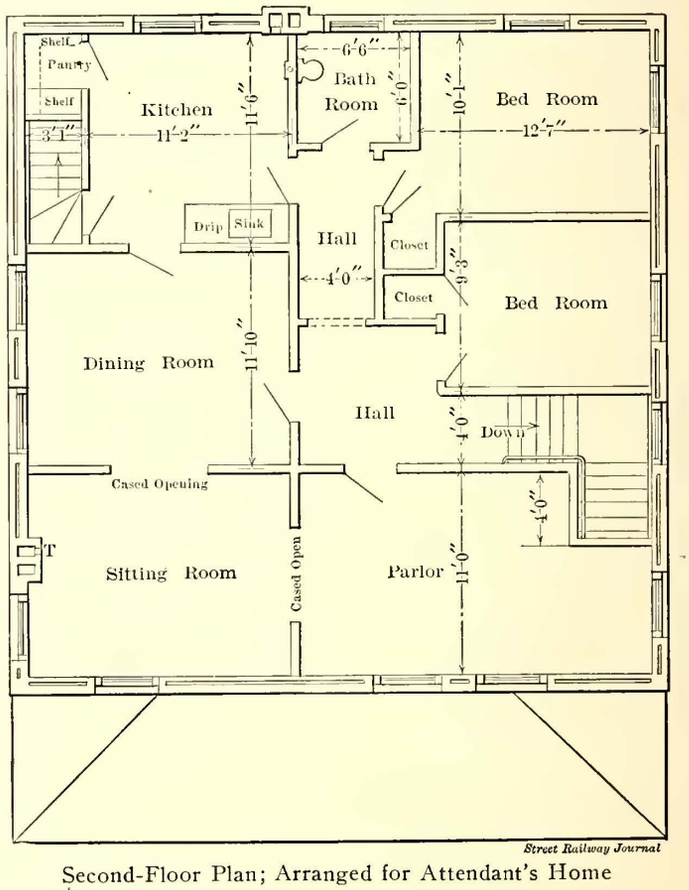
The sub-station buildings are all of similar design. They are located in the villages, making them convenient for passenger and freight requirements. The buildings, one of which is illustrated, are of unusually attractive design. They are two stories high and are built of paving brick with stone trimmings, and cost about $3,500 each. Ticket office, waiting-room and baggage room occupy the front half of the first floor, while the attendant and his family occupy a fine suite of seven rooms on the upper floor. Rent and light are furnished free to the attendant, and in this way a very superior class of help can be secured at a reasonable figure for this service. The attendant has entire charge of the station, taking care of the electrical equipment, besides handling baggage and freight and selling tickets. He is also supposed to keep the passenger and freight solicitors informed as to opportunities for securing business. At these stations patrons are permitted to use the telephone in ordering goods to be shipped over the electric road. At Blissfield there is a freight station in addition to the usual rotary station, while at several of the smaller towns there are neat frame buildings designed for the service and known as second-class stations.

PARKS AND OTHER ATTRACTIONS

Within a short run of Toledo the company has established a baseball park and racetrack. On Sundays during the last season a professional team played regular scheduled games. On other days the park is turned over to clubs who arrange for dates. Admission to the park is free, but a small charge is made for grandstand seats. Another season the company will probably establish a park and summer resort on a site that has been selected because of its many natural advantages.



First-Floor Plan.



Second-Floor Plan; Arranged for Attendant's Home

GENERAL ARRANGEMENT OF SUB-STATION BUILDINGS

ORGANIZATION

The Toledo & Western Railway Company has an authorized capital stock of $1,800,000, with $1,300,000 issued or to be issued. The bonded indebtedness is $1,250,000, or less than $19,000 per mile. At the present time the stockholders are considering a proposition to increase the bonded indebtedness by $250,000 to take over the road and property of the Toledo, Fayette & Western, a company formed recently to build a 12-mile extension from Fayette to Pioneer. This is now under construction, and when the deal is effected the Toledo & Western mileage will be increased to 80 miles.

The stock of the company is closely held by Cleveland and Toledo people who took up the proposition in its infancy, with the belief that it would prove a safe investment, and already the property is showing up in a most satisfactory manner. The gross earnings for a recent month were about $14,000, of which over $4,000 was derived from freight and milk. The figures have increased each month since the road has been in operation, and the proportion of the freight receipts to the total is steadily gaining At the present the property is being operated for 53 per cent, but it is believed when everything is in smooth running order this will be brought below 50 per cent. The road is already paying fixed charges, and the earnings will be largely increased when the new extension is completed and better terminal facilities are afforded at Adrian. An expensive undergrade crossing is being built on the outskirts of that city to enable the Toledo & Western cars to connect with the city line. When this work is completed they will run to a terminal station now being arranged for.

The officers of the company are: Hon. Luther Allen, Cleveland, president; J. R. Seagrave, Cleveland, vice-president; F. E. Seagrave, Toledo, secretary and assistant treasurer; C. F. Franklin, general manager; J. S. Clark, purchasing agent; C. T. Chapman, general freight and passenger agent; Frank T. Oakley, chief engineer, and Frederick B. Perkins, consulting mechanical and electrical engineer. Mr. Perkins had entire charge of the designing of the electrical and mechanical equipment of road.

Hon. Luther Allen, president of the company, is also president of the Cleveland, Painesville & Ashtabula Railway, which is being built between Painesville and Ashtabula, and of the Buffalo, Dunkirk & Western Railway, which is projected from Buffalo westward. These two roads will close the last gaps between Buffalo and Toledo, and it is probable that by the time both are completed the Indiana links will have been closed up, affording an unbroken line from Buffalo to Chicago, in which the syndicate headed by Mr. Allen will be a most important factor in case of ultimate consolidation.

Jersey Trolley Tunnel

The New York & New Jersey Company's tunnel franchise was passed by the Board of Aldermen last Tuesday, and, as there has been no opposition to the project, it will doubtless receive the Mayor's approval. It is proposed, under the terms of this grant, to complete the Hudson tunnel and operate trolley cars betwen Jersey City and Christopher Street, New York, under thirty-second headway and making the trip in ten minutes. Under the terms of the franchise the city is to receive 3 per cent of the gross receipts of the company on that portion of the railway lines in New York for the first five years, and 5 per cent thereafter. The tunnel will enter New York at Morton Street, and will run up Morton to Greenwich Street, thence along Greenwich Street to the block bounded by Christopher Street, West Tenth Street, Greenwich Street and Hudson Street, where the terminal for Manhattan is to be located. The terminals for New Jersey probably will be at the Erie and Delaware & Lackawanna stations.

The Series Alternating Motor Problem

BY GEORGE T. HANCHETT

In view of the brilliant promises which have been made by prominent manufacturing companies with reference to single-phase alternating current railway motors, it becomes interesting to review the problem which they profess to have successfully solved.

A preliminary paragraph reviewing the condition of direct-current motor commutation may be useful in considering the matter. For this purpose reference may be had to Fig. 1, which illustrates diagrammatically the relative mechanical arrangement of the pole piece, commutator and brush, and also the armature coils. In this illustration a ring armature is chosen, as it is somewhat simpler to show diagrammatically, and the following discussion applies to that type of winding, but it will be understood that the same principles apply equally to all forms of drum armature commutation.

For perfect commutation the bobbin V is received under the brush and held short-circuited thereby until its motion in the field has induced a sufficient electromotive force to reverse the current and give it the same magnitude as that of the working circuit of the armature to which it is about to be delivered. The bobbin V is already in a field generating such an electromotive force, which,

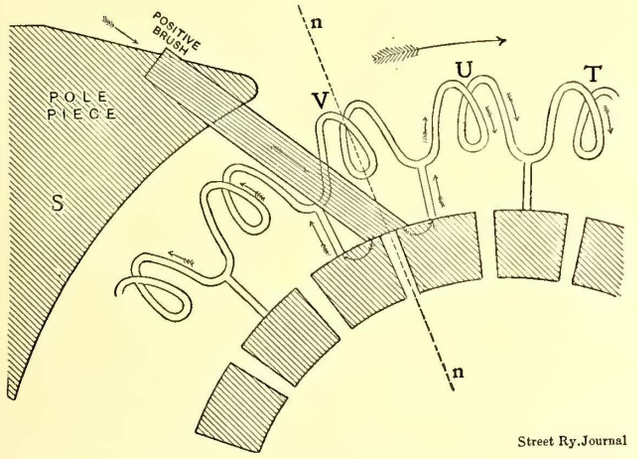


FIG. 1.—RELATIVE POSITION OF POLE PIECE, BRUSH, COMMUTATOR, AND ARMATURE COILS

while it was in an earlier position was opposing the flow of current from the positive brush. The act of commutation, therefore, takes place before V has passed out of this field, and as the resistance of the bobbin is small, it usually takes place at a point in the rotation where the time-rate of change, due to its motion, is not very great. In fixed brush commutation, which is the only commutation we can consider in railway motor work, the current in the bobbin V, while it is short circuited by the brush, which we will call the short-circuit current, depends for its magnitude upon the velocity of the motion of the bobbin, its reactance and the strength of the field. It is not absolutely necessary that the current in V shall be equal in magnitude to the current in U when it is released. Reasonably sparkless commutation can occur without this condition being exactly fulfilled. For example, in motors having a practically constant speed and field, the final value of the short-circuit current is always the same, also while that of the bobbin U and T may vary quite considerably, according to the load on the machine. The reason that alternating-current series motors have encountered such formidable commutation troubles is because other and very variable influences influence the magnitude and direction of this short-circuit current, and it is these variable influences which are about to be discussed.

In the case of the alternating-current railway motor, concerning which performance and construction data are awaited, the frequency has been reduced to 16 2-3 cycles per second. This figure is so much lower than the number of commutations per second that there are probably not less than 150 commutations per cycle, or 75 per alternation. Consulting Fig. 2 it is plain that these commutations occur at equal linear distances along the horizontal axis of the alternating-current curve, and for convenience these have been marked off on the diagram and numbered one to twelve respectively, each interval denoting a space during which about six commutations take place. This curve can also be used to represent the strength of the field, to which it is directly proportional, and upon which the commutation directly depends. It will be easily seen that there are, therefore, seventy-five different commutation conditions due to this cause alone, which must be met by a single construction of brush and armature coil arrangement, and which is, therefore, a severe tax on the designer's skill.

In any of these commutation positions it will be seen at once that the short-circuit current is due to an electromotive force which has two components, one the component due to the motion in the field, as in the case of direct currents, and the second due to the variation of the field itself, the resultant voltage being equal to their vector sum.

It will be noticed that at zero current in the system, and at zero field the motion of the bobbin can induce very little electromotive force, but the rapid variation of the field is capable of considerably influencing the short-circuit current; in fact the bobbin must depend for its current reversal very largely on the rate of change due to the increasing field. Further up the crest, as positions three and four, the motion of the bobbin and the increasing field combine together in more equal measure to produce the resultant voltage. At the top of the crest, say at position seven, where the field is for the instant steady, the resultant voltage is due almost entirely to the motion of the bobbin. On the other side of the crest the resultant voltage is increased by the motion of the bobbin and diminished by the diminishing field, and the vector sum thereof may be less than either of the components.

It is now necessary to take into account the fact that as the commutation occurs at various points along the crest, it is necessary for sparkless operation to adjust the short-circuit current to harmonize in direction and magnitude with a varying and not a constant current, as is the case in direct-current work. As has been pointed out in a previous paragraph there is, fortunately, a considerable latitude in this particular, and the currents need not agree so closely in magnitude provided that they agree in direction. As long as the current is well reversed and given reasonable magnitude, we need not fear trouble at the commutator. Therefore, on the ascending side of the crest, where the two forces

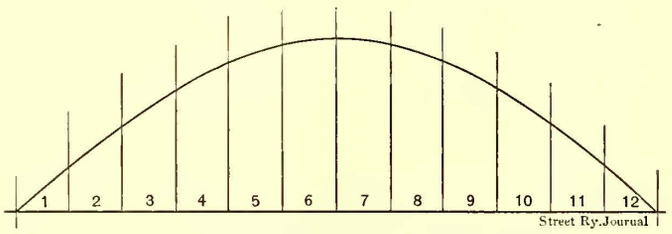


FIG. 2.—DISTANCES OF COMMUTATION

unite to effect reversal, we may expect reasonably good commutation if the current with which it is to be harmonized is increasing also. As the top of the crest is passed the field magnetism begins to die away and induce in the bobbin an electromotive force opposed to that due to its motion, thus reducing the resultant current as the event occurs to a greater degree as the commutation occurs further and further down the curve. The load current with which it is to be commutated is, however, reducing also, and hence, for a portion of the curve at least, we may expect reasonable commutation. In short, these variations at some points tend to harmonize with good commutation, and if the clever designer can so evaluate the two component electromotive forces as to produce a resultant voltage which, when impressed on the bobbin, will give a short-circuit current, which will rise and fall with the load current and agree with it in direction, we may expect even better commutation than obtains in direct-current work. Unfortunately, it is very difficult to do this so that the result will be sufficiently good for practical purposes. In order that the motor shall have a strong torque and shall be of light weight its field must be strong, and hence the component of the resultant short-circuit voltage due to varying field is correspondingly large, and on the descending side of the curve it may overpower the component due to the bobbin's motion, and even deliver the bobbin to the working circuit carrying current opposite in direction from that which it should have, and trouble from sparking can, therefore, be expected at those commutations which occur when the current is diminishing. If it so happened that the motor was run for a long time at commutation frequency which was an even multiple of the alternating-current frequency, the commutation troubles might be expected to blacken the commutator in stripes. It, therefore, becomes interesting to speculate as to the ways and means which have been employed to meet this very formidable difficulty, even though we have been promised exact data at a very early date.

The simplest way to avoid the trouble is to proceed as has been

indicated in the preliminary announcements, namely, to reduce the commutating component due to varying field. This can be accomplished in two ways. First, by weakening the field, which is objectionable for several reasons, and second, by increasing the peripheral speed of the armature so that the bobbins are moving in the field very rapidly, and the electromotive force due to their motion is therefore large, as compared with the electromotive force due to field variation. A third expedient is to make the number of turns per bar a minimum. This has a very beneficial effect, because it materially increases the permissible difference between short-circuit current and working current on precisely the same principle that open circuiting a large number of lamps into a constant current-arc circuit produces a greater spark at the switch than does a similar action with a single lamp. A further advantage obtains in the fact that the inductance of the bobbin is thereby much reduced. This inductance is a very unmanagable variable. It is plain that the bobbin is received under the brush carrying all values of flux from zero to maximum, and if the iron has a tendency to hysteresis, it is almost impossible to predict what these values will be, and the best plan is to reduce their effects to a minimum. This has undoubtedly received most careful consideration at the hands of the designers. In discussing the relative values of these various expedients it may be stated at once that reduction of field strength can only be indulged in to a very limited extent. The reduction of the field strength undoubtedly reduces the strength of the disturbing commutation component due to alternating field, but it brings in its train a long line of evils due to armature reaction with which every one is familiar. An intense field has been the salvation of railway commutators with fixed brushes, and it is not reasonable to believe that any wider departure than necessary has been made in this case. However, a moment's consideration will render plain that some step of this kind has been to a certain extent unavoidable.

A well-known 117-hp direct-current railway motor, recomputed to operate at 220 volts, the same voltage that is used on the single-phase motor, would have seventy-nine turns on its field magnets, each of which will surround 23,800,000 lines of force. It may readily be computed that if such a field were used in an equal alternating-current motor of power factor 90, the necessary voltage to force 440 amps. through the field coils at 16 2-3 cycles per second, would be over 200. As there are only 220 volts available per motor, it is highly probable that a field structure of a lesser number of flux-turns has been employed. It must not be forgotten, however, that this is mostly reactance drop, and if the armature is fairly non-inductive the net volts at its terminals will not suffer such serious diminution as if the field drop were due entirely to resistance. The current in the field coils is practically wattless, and the voltage at their terminals is therefore almost 90 degs. displaced. If the armature circuit operates practically non-inductively, and it must do so if the power factor is to be kept down, 200 volts could be available at its terminals, and leave 90 volts for the field coils, even though the total voltage were only 220. However, it will be seen that in spite of this alternate current peculiarity in favor of the machine a field of considerably reduced flux turns must be employed.

The speed of the new motor is 700 r. p. m., an increase of some 30 per cent over the speeds commonly used in direct-current work for motors of this capacity, and as the motor has eight poles it is evident that there are many conductors on the surface of the armature, which is, therefore, of large diameter and high bobbin velocity, which is in accordance with previous considerations. Moreover, the necessarily reduced field would demand more conductors in order to preserve the torque intact and keep the speed within rasonable limits. The designer has been fortunate in the fact that because of the flexibility of alternating currents he is able to reduce the voltage at the brushes, for that will materially assist in obtaining good commutation.

It remains to be said that the design of the entire machine has, without doubt, been a struggle between two fires. The field must be strong to preserve torque and keep down the armature reaction. It must be weaker than usual to reduce the commutating component due to the field variations, and to present a circuit of a reasonably small number of flux turns, which is necessary both for the purpose of reducing the voltage necessary to force the current through them and to keep up the power factor. The armature is preferably of small diameter and few turns, in order to keep down armature reaction, fly-wheel capacity and cost of construction. It must be large in diameter to provide increased bobbin velocity, and must have many turns to preserve its torque and keep down its speed. The commutator must have few bars, to keep down its cost, but on the other hand there must be few turns per bar, and consequently many bars in order to keep down the bobbin reactance. Lastly, the designer has new losses to take from the merit of his efficiency curve, first, the increased hysteresis in the armature, and an entirely new hysteresis in the field, together with increased eddy-current losses in both of these structures. Secondly, an increased $C^2 R$ loss in the entire structure, due to the fact that it uses alternating currents, and, therefore, has a power factor. Thirdly, the losses of the various transformers and balance coils which are a necessary adjunct to the equipment must be figured in; in short, the entire design is handicapped with contradictory conditions and increased sources of loss.

The production of a series alternating-current motor of this capacity that will give any sort of commercial service, is a subject for congratulation, but to produce one that will rival a direct-current proposition to the degree shown in the curves that have been presented, is indeed a triumph, on which the designer is to be most warmly congratulated.

In conclusion it is gratifying to observe that the enterprise is backed by a large company, who is willing to risk much financially and more in reputation in the endeavor to evolve practical results from this daring experiment. Its success is earnestly to be hoped for, and the commercial reward which will inevitably follow will be well deserved.

Plans for East Side Subway

It is announced that with the adoption of the real estate assessment roll of New York for 1903, the increased value of the city's real estate will enable the municipality to engage in actual work upon the extension of the present subway system, and that the needs of the East Side will then be considered. Last September the Rapid Transit Commission passed a resolution instructing Chief Engineer Parsons to prepare a general plan for a complete tunnel system, embracing all parts of the city, and work in this comprehensive plan has since been under way. It was understood then that the East Side line would be built, but the prospect of having it started during 1903 was not considered until a few weeks ago.

Now, however, Mayor Low, Comptroller Grout and President Alexander E. Orr, of the Rapid Transit Commission, have agreed that the city shall have an East Side subway soon.

The building of an East Side line, which has been speculated upon as something in the vague future, was not provided in the original subway scheme, because the necessary outlay of money was not possible with the constitutional provision as to the municipal debt in the way. As soon as the debt limit is increased, it is the intention of the commission immediately to adopt plans for this extension. Although the chief engineer has not submitted his report on the matter, it is considered probable that the route will be along Lexington Avenue. Trains bound for the upper East Side will travel on the regular tracks of the original underground railroad from the downtown terminal up to a point in Park Avenue not far south of Fortieth Street. Then they will be switched to other rails, and at Forty-Second Street, opposite the Grand Central Station, the curve eastward will be made underneath the tracks that run west toward Broadway.

Rules for New York State Street Railway Association

At the September meeting of the Street Railway Association of the State of New York, the report of the committee on rules was very carefully discussed, but no definite action was taken; instead, a resolution was adopted, it will be remembered, providing that the committee on rules be continued; that the report of the committee on rules be referred back to the committee; that each company be given thirty days in which to file any objections, suggestions or amendments to the rules with the committee; that within thirty days after the expiration of such terms the committee formulate and make its final report in printed form to the executive committee, and the executive committee be authorized to promulgate and make effective these rules.

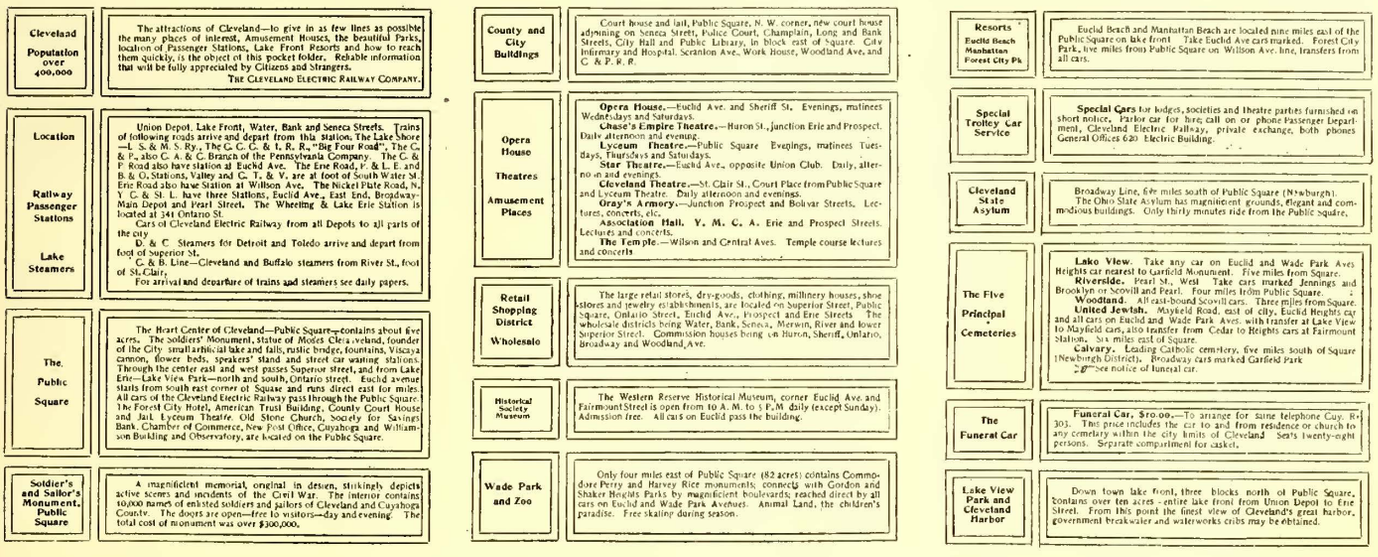
The committee, consisting of E. G. Connette, of the Syracuse Rapid Transit Company; Oren Root, Jr., of the Metropolitan Street Railway Company; J. C. Brackenridge, of the Brooklyn Heights Railroad Company; Edgar S. Fassett, of the United Traction Company, of Albany; J. P. E. Clark, of the Binghamton Railroad Company, and T. E. Mitten, of the International Railway Company of Buffalo, has agreed upon a form of rules, and has reported them to the executive committee in compliance with the resolution.

Some members of the association's executive committee have made suggestions with reference to the rules, more particularly in regard to the form than in the matter of substance, and Secretary Robinson has ordered them printed. It is expected that copies will be ready for distribution early in the year.

Traffic Circulars of the Cleveland Electric Railway Company

In a recent issue the traffic circulars of the Aurora, Elgin & Chicago Railway were published, and the statement was made at that time that it was the intention of this paper to publish similar circulars of other railway companies. It is thought that these leaflets will furnish suggestions which will be of assistance to other companies in publishing similar literature.

The Cleveland Electric Railway Company has given especial attention to the subject of developing traffic, and has a department similar to the general passenger department of a steam railroad company, but called an "Outing Department." This department is under the management of J. W. Butler, who has charge of all of the advertising of the company, the publication of traffic circulars, etc., in addition to other duties which pertain to that department. It is often thought that while interurban railways may find it profitable to publish circulars in regard to the points of interest reached by their lines, the same arguments would not apply to city companies. This is not the theory, however, held in Cleveland, and some of the most attractive circulars issued by the Outing Department relate to encouraging city traffic. One of these is a sheet 21 ins. x 6¾ ins., but so folded that it is brought down to a convenient pocket size. It is entitled "Nickel Trolley Rides in and About Ohio's Greatest City, Points of Interest, Public Parks and Boulevards, How to Reach Them." The leaflet is printed in green type with red borders. This fact makes a good photographic reproduction very difficult, but samples of a few of the pages are presented herewith.



Cleveland Population over 400,000	The attractions of Cleveland—to give in as few lines as possible the many places of interest, Amusement Houses, the Beautiful Parks, location of Passenger Stations, Lake Front Resorts and how to reach them quickly, is the object of this pocket folder. Reliable information that will be fully appreciated by Citizens and Strangers. THE CLEVELAND ELECTRIC RAILWAY COMPANY.
Location Railway Passenger Stations Lake Steamers	Union Depot, Lake Front, Water, Bank and Seneca Streets. Trains of following roads arrive and depart from this station, The Lake Shore —L. S. & M. S. Ry., The C. C. C. & I. R. R., "Big Four Road", The C. & P., also C. A. & C. Branch of the Pennsylvania Company. The C. & F. Road also have station at Euclid Ave. The Erie Road, P. & L. E. and B. & O. Stations, Valley and C. T. & V. are at foot of South Water St. Erie Road also have Station at Willson Ave. The Nickel Plate Road, N. Y. C. & St. L. have three Stations, Euclid Ave., East End, Broadway-Main Depot and Pearl Street. The Wheeling & Lake Erie Station is located at 341 Ontario St. Cars of Cleveland Electric Railway from all Depots to all parts of the city D. & C. Steamers for Detroit and Toledo arrive and depart from foot of Superior St. C. & B. Line—Cleveland and Buffalo steamers from River St., foot of St. Clair, For arrival and departure of trains and steamers see daily papers.
The Public Square	The Heart Center of Cleveland—Public Square—contains about five acres. The soldiers' Monument, statue of Moses Cleaveland, founder of the City small artificial lake and falls, rustic bridge, fountains, Viscaya cannon, flower beds, Speakers' stand and street car waiting stations. Through the center east and west passes Superior street, and from Lake Erie—Lake View Park—north and south, Ontario street. Euclid avenue starts from south east corner of Square and runs direct east for miles. All cars of the Cleveland Electric Railway pass through the Public Square. The Forest City Hotel, American Trust Building, County Court House and Jail, Lyceum Theatre, Old Stone Church, Society for Savings Bank, Chamber of Commerce, New Post Office, Cuyahoga and Williamson Building and Observatory, are located on the Public Square.
Soldier's and Sailor's Monument, Public Square	A magnificent memorial, original in design, strikingly depicts active scenes and incidents of the Civil War. The interior contains 10,000 names of enlisted soldiers and sailors of Cleveland and Cuyahoga County. The doors are open—free to visitors—day and evening. The total cost of monument was over $300,000.
County and City Buildings	Court house and Jail, Public Square, N. W. corner, new court house adjoining on Seneca Street, Police Court, Champlain, Long and Bank Streets, City Hall and Public Library, in block east of Square. City Infirmary and Hospital, Scranton Ave., Work House, Woodland Ave. and C. & P. R. R.
Opera House Theatres Amusement Places	**Opera House.**—Euclid Ave. and Sheriff St. Evenings, matinees Wednesdays and Saturdays. **Chase's Empire Theatre.**—Huron St., junction Erie and Prospect. Daily afternoon and evening. **Lyceum Theatre.**—Public Square Evenings, matinees Tuesdays, Thursdays and Saturdays. **Star Theatre.**—Euclid Ave., opposite Union Club. Daily, afternoon and evenings. **Cleveland Theatre.**—St. Clair St., Court Place from Public Square and Lyceum Theatre. Daily afternoon and evenings. **Gray's Armory.**—Junction Prospect and Bolivar Streets. Lectures, concerts, etc. **Association Hall. Y. M. C. A.** Erie and Prospect Streets. Lectures and concerts. **The Temple.**—Wilson and Central Aves. Temple course lectures and concerts
Retail Shopping District Wholesale	The large retail stores, dry-goods, clothing, millinery houses, shoe stores and jewelry establishments, are located on Superior Street, Public Square, Ontario Street, Euclid Ave., Prospect and Erie Streets. The wholesale districts being Water, Bank, Seneca, Merwin, River and lower Superior Street. Commission houses being on Huron, Sheriff, Ontario, Broadway and Woodland Ave.
Historical Society Museum	The Western Reserve Historical Museum, corner Euclid Ave. and Fairmount Street is open from 10 A. M. to 5 P. M. daily (except Sunday). Admission free. All cars on Euclid pass the building.
Wade Park and Zoo	Only four miles east of Public Square (82 acres) contains Commodore Perry and Harvey Rice monuments; connects with Gordon and Shaker Heights Parks by magnificent boulevards; reached direct by all cars on Euclid and Wade Park Avenues. Animal Land, the children's paradise. Free skating during season.
Resorts Euclid Beach Manhattan Forest City Pk	Euclid Beach and Manhattan Beach are located nine miles east of the Public Square on lake front. Take Euclid Ave cars marked. Forest City Park, five miles from Public Square on Willson Ave. line, transfers from all cars.
Special Trolley Car Service	**Special Cars** for lodges, societies and theatre parties furnished on short notice. Parlor car for hire; call on or phone Passenger Department, Cleveland Electric Railway, private exchange, both phones General Offices 620 Electric Building.
Cleveland State Asylum	Broadway Line, five miles south of Public Square (Newburgh). The Ohio State Asylum has magnificent grounds, elegant and commodious buildings. Only thirty minutes ride from the Public Square.
The Five Principal Cemeteries	**Lake View.** Take any car on Euclid and Wade Park Aves Heights car nearest to Garfield Monument. Five miles from Square. **Riverside.** Pearl St., West Take cars marked Jennings and Brooklyn or Scovill and Pearl. Four miles from Public Square. **Woodland.** All east-bound Scovill cars. Three miles from Square. **United Jewish.** Mayfield Road, east of city. Euclid Heights car and all cars on Euclid and Wade Park Aves. with transfer at Lake View to Mayfield cars, also transfer from Cedar to Heights cars at Fairmount Station. Six miles east of Square. **Calvary.** Leading Catholic cemetery, five miles south of Square (Newburgh District). Broadway cars marked Garfield Park. See notice of funeral car.
The Funeral Car	**Funeral Car, $10.00.**—To arrange for same telephone Cuy. R-303. This price includes the car to and from residence or church to any cemetery within the city limits of Cleveland. Seats twenty-eight persons. Separate compartment for casket.
Lake View Park and Cleveland Harbor	Down town lake front, three blocks north of Public Square, contains over ten acres—entire lake front from Union Depot to Erie Street. From this point the finest view of Cleveland's great harbor, government breakwater and waterworks cribs may be obtained.

SAMPLE PAGES FROM CLEVELAND TRAFFIC CIRCULAR

The circular, as shown from the sample pages, gives directions to strangers for reaching the principal points of interest in the city, including the hotels, express offices, etc., and is decorated on the back leaf by an engraving of the Garfield tomb, with which are given directions for reaching this monument.

These advertisements are distributed in a variety of ways, as through hotel and depot time-table racks, and in other ways by which they will be brought to the attention of strangers and others who would be particularly interested in taking trips about the city. The experience of the company with them as promoters of traffic has been most gratifying.

Time Limit on Transfers

In the case of Garrison against the United Railways & Electric Company in the Court of Common Pleas, of Baltimore, Judge Harlan made a ruling upon transfers which is of interest to the public. The action was for wrongful ejection from a street car, and for assault and battery.

Plaintiff testified that he boarded a car of the defendant about 3:45 p. m., and the conductor gave him a transfer punched 3:50; that he rode several squares to the transfer point and waited ten or fifteen minutes for a car, and took the first car that came; but that when he presented the transfer it was after 4 o'clock. The transfer read that it was "not good after the hour punched in the margin," and had, therefore, expired.

Judge Harlan ruled that the transfer was conclusive evidence between the passenger and the conductor as to the passenger's right to ride, and that inasmuch as the transfer was bad on its face the conductor had the right to demand that the passenger pay his fare or get off the car, and in the event of his refusal that he then had the right to use all reasonable and necessay force to expel him.

Counsel for defendant argued that the transfer was conclusive evidence as between the passenger and the conductor to whom the transfer was presented, and that if there had been any error by any agent of the company by which plaintiff had been injuriously affected, the latter's rights were in action for breach of contract; that it was the duty of the passenger, under the circumstances, in the interest of public policy to pay his fare, postpone his claim, and not compel the conductor to eject him. Any other ruling, it was argued, would either compel a conductor to accept the word of every passenger who had a transfer that was bad upon its face, and thus open the door to continuous frauds, or else he would be obliged to eject every passenger who had a bad transfer and refused either to pay or leave the car. In other words such a ruling would present only a choice between extensive frauds or breaches of the peace upon the car, which alternative, in the interest of public policy, should not be presented to the defendant.

In support of these contentions counsel for defendant cited many authorities and decisions, including the following: P. W. & B. R. R. vs. McLure, 34 Md., 532; P. W. & B. R. R. vs. Pennington, 62 Md., 95; W. M. R. R., vs. Stocksdale, 83 Md., 245; U. Ry. & E. Co. vs. Hardesty, 94 Md., 661; Wakefield vs. South Boston R. R. Co., 117 Mass., 544; Bradshaw vs. South Boston R. R. Co., 135 Mass., 407; Brown vs. R. Ry. Co., 90 N. W. Rep., 290; C. B. & Q. vs. Griffin, 68 Ill., 499; 37 Mich., 346; 54 Wis., 234; 56 N. Y., 295; 9 Am. Neg. Ry., 476; 38 La. Ann., 930; Riley vs. Chicago Ry. Co., 186, Ill.; Deen vs. Detroit Ry. Co., 123, Mich.

Counsel for plaintiff cited the act of 1900, ch. 313, compelling the defendant to give free transfers in the city which should "be good for a continuous ride," but it was contended and so ruled that this did not prevent the company from making reasonable regulations for its own protection, compelling passengers to produce proper evidence of their rights so to ride.

Plaintiff also testified that after the car had gone seven or eight squares from the place where the conductor demanded that he pay his fare or get off, the car was stopped, and the conductor called a policeman; thereupon, one of the plaintiff's friends with whom he was riding offered to pay his fare, which the conductor refused and attempted to eject him.

Another prayer granted by Judge Harlan was to the effect that if, after the demand by the conductor for payment of fare, a reasonable time had been given by him to comply therewith, and the car had been stopped for the purpose of ejecting the passenger, the conductor was not at that time obliged to accept a tender of fare by the passenger, but still had the right to eject him.

Plaintiff further testified that after he had offered to get off and while so doing, he claimed, the conductor pushed him from behind against the controller of the car, and thus injured his arm. This evidence was contradicted by witnesses, but the case went to the jury on the question of whether unnecessary or excessive force had been used upon the plaintiff.

The jury returned a verdict for the defendant, thus sustaining the company in its position throughout. It is believed that the case will be carried to the Court of Appeals.

New Open Cars for the Brooklyn Elevated

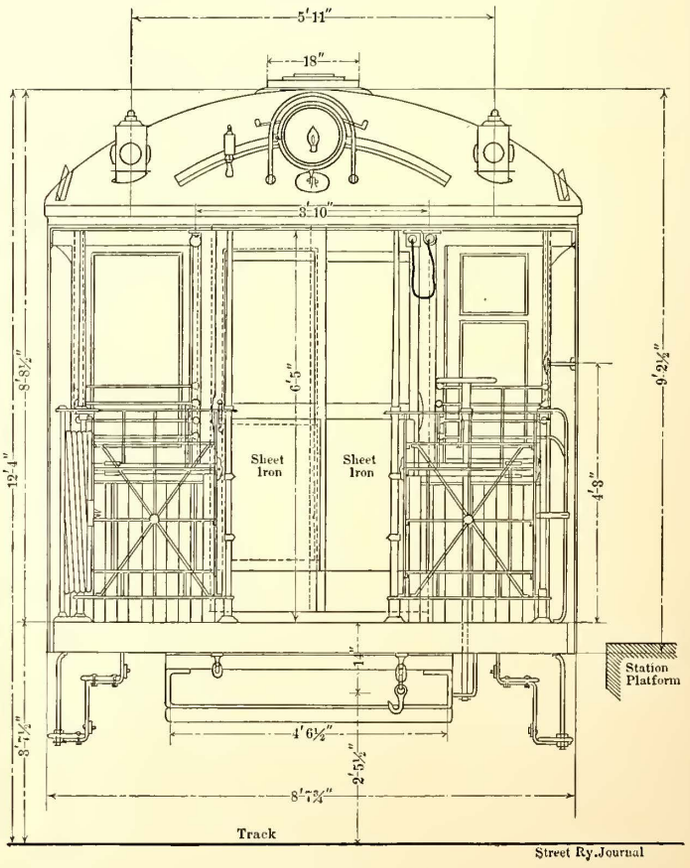
The Brooklyn Rapid Transit Company has operated on its elevated system during the last few years a number of open cars. These cars have been of a somewhat peculiar type, having open sides and cross seats, entrance being made at the ends, and rails being placed at the sides of the seats to prevent passengers from falling out. The cars which have been operated were all trailers, however, and the need of running complete trains of open cars has induced the company to order 120 cars of the type shown in the accompanying drawings. While these cars follow, in some measure, the lines of the older style, there is a great improvement both in appearance and strength in the new cars.

Before it was decided to adopt the plans, a model was constructed in the shops of the railway company, photographs of which are reproduced herewith. This model gave the officers, car-builders and the supply houses a chance to thoroughly investigate the requirements of the new type of car, and resulted in making several improvements in the original ideas. It is thought that possibly a panel will be placed in the window openings, converting the car into a closed one, but nothing has been definitely decided upon this subject. One of the illustrations shows a panel so placed between the center side posts of the model. This panel contains a fixed glass window, and can be readily screwed into place when it is desired to change the car from summer to winter service. The panel shown is, of course, only a suggestion, and if the idea is ever carried out the window opening will probably be somewhat larger than that shown in the cut.

The length of the car over platforms is 48 ft. 11 ins., the car body being 40 ft. 5 ins. This gives a platform of 4 ft. 3 ins. The width over side sills is 8 ft. 5¾ ins., and the car's width at the drip rails is 8 ft. 9¼ ins. From bottom of sills to top of roof the height is 9 ft. 2½ ins., and from top of rail to top of roof it is 12 ft. 4 ins. The tracks are to have a wheel base of 6 ft., the distance from center to center of trucks being 33 ft. 6 ins. and the diameter of wheels 33 ins. The roof, which extends over the platform in a

MODEL OF OPEN ELEVATED RAILWAY CAR, WITH AND WITHOUT CONVERTING PANEL

MODEL OF OPEN CAR—INTERIOR

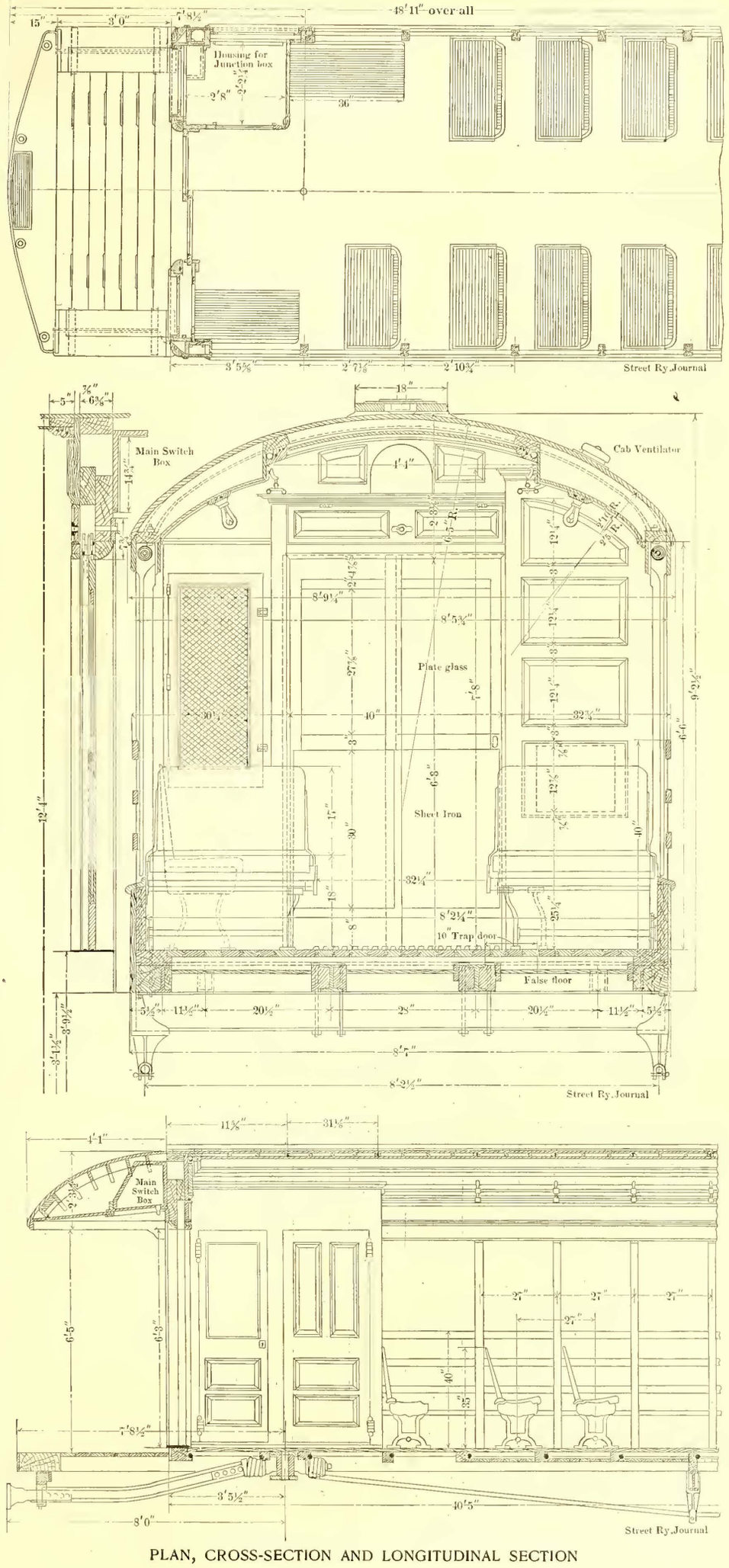


END ELEVATION

hood continuous with the main roof frame, is of the single-deck type without clere-story, but has an imitation clere-story inside, as seen in the cross-section view. Ventilators in the roof are provided for the motorman's cab, and if it is decided to adopt the panel for the winter service, additional ventilators may be necessary for supplying the interior of the car with fresh air. The cars are to be wired for four circuits of lights, the lights being placed along the sides of the roof. The sills, which are four in number, are made of 5-in. 12¼-lb. standard I-beams, the two outside sills having a wood filling flush with the inside edge of I-beam and an outside filler, making a width of 6½ ins. The platform is to be supported by two intermediate sills, running to the outer edge of the end stick, and two platform knees formed of two 4-in. 5¼-lb. channels with wood filler running from the end stick to the bolster. All the moldings, sash, doors, etc., are to be of ash, natural color, including the wooden strips which run along the open sides of the car. In order to obtain a wide door opening, without using a door sliding so as to obstruct the motorman's view, a double door, which opens to one side, was designed. The doors contain sash ⅝ of an inch thick in the upper part, which drop into the space between the sheet-iron panels in the lower part, and have spring latches to hold them in place. The doors are hung by brass sheaves from tracks of flat iron, with rollers both above and below the track. The details of the equipment are to be the same as that of the Brooklyn Rapid Transit Company's standard closed car equipment. Nearly all have been decided upon and include W. T. Van Dorn Company's couplings, Universal safety tread, Christensen air-brake equipment, and Westinghouse motor equipment. The contract for 120 of these cars was given last week to the John Stephenson Company, of Elizabeth, N. J., and work will be immediately commenced in order that the cars may be put in operation the coming summer.

Syracuse Rapid Transit Gets Control of the Oswego Traction Company

W. P. Gannon, president, and E. G. Connette, general manager of the Syracuse Rapid Transit Railway Company, announced on Wednesday that they had closed a deal with C. S. Shepard for the street railway system of Oswego, operated by the Oswego Traction Company. The deal is important because of its bearing on the fight between the Syracuse Rapid Transit Company and the Syracuse, Lakeside & Baldwinsville Railway for franchise right between Syracuse and Oswego, both companies desiring to build a road between the two cities. It is reported that the purchase includes all of the first-mortgage bonds of the Oswego Traction Company, and all but 10 per cent of the capital stock and second-mortgage bonds. The company's capital stock amounts to $300,000, the first-mortgage bonds to $100,000 authorized and $97,000 issued, and the second-mortgage bonds to $200,000 authorized and $191,000 issued. The company operates 11½ miles of railway, including all in Oswego, with lines running out to Beach Oswego and Minetta.



PLAN, CROSS-SECTION AND LONGITUDINAL SECTION

Steam Turbines with Special Reference to the De Laval Type of Turbine*

BY KONRAD ANDERSON

The present construction of the De Laval Turbine is founded on the action principle. The steam is blown from stationary nozzles against vanes or buckets fixed in the circumference of a wheel, and the stem thus impinging on the vanes drives the wheel round. There is only one row of buckets on the wheel, the steam in passing this row delivers most of its energy and is afterwards exhausted either to the atmosphere or to a condenser in the ordinary way. The principle of the machine is very similar to the action turbine for water as constructed by Girard. As is the case with all action turbines, the working of the machine depends on the kinetic energy of the medium which drives it, and the higher the kinetic energy the more power is obtained. It is therefore important that the driving medium, which in this case is steam, should have a high kinetic energy, or (which is the same) that every pound of steam used should enter the turbine wheel at as high a speed as can be obtained, and further, that as much as possible of this speed should be utilized by the buckets of the turbine wheel.

A high speed of the driving steam is obtained by expanding the

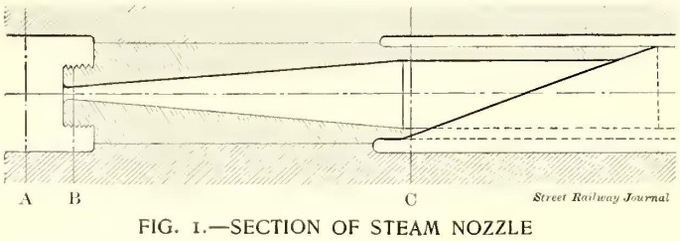


FIG. 1.—SECTION OF STEAM NOZZLE

admission steam in conical nozzles, specially adapted and constructed for this purpose. The steam is expanded adiabatically from its original pressure down to the pressure which prevails in the chamber where the turbine wheel revolves. If, for instance, the turbine works with 200 lbs. admission pressure and 28 ins. vacuum, corresponding to 0.93 lb. absolute pressure, the steam is expanded in the nozzles from 200 lbs. per square inch above the atmosphere down to 0.93 lb. per square inch absolute pressure. This expansion gives the steam, which leaves the nozzle in a jet, a very high velocity of outflow. Professor Zeuner has made extensive tests on the outflow of steam, and has shown theoretically and also proved by numerous experiments, that if the steam is expanded adiabatically in the nozzle, all the potential energy of the steam is transformed into kinetic energy, and that the kinetic energy of steam thus expanded is absolutely identical to the amount of work which the same steam would have done had it been expanded in the same proportion in the cylinder of an engine. Table I. gives the velocity of outflow of steam at different admission pressures, expanded in nozzles down to 1 atmosphere, 25 ins. vacuum and 28 ins. vacuum respectively.

TABLE I

The velocity of outflow and the working capacity of dry saturated steam

Initial Steam Pressure, lbs. per Square Inch	Counter-pressure 1 Atm.			Counter-pressure 2.4 lbs. per Square Inch Absolute Corresponding to 25 in. Vacuum			Counter-pressure 0.93 lbs. per Square Inch Absolute Corresponding to 28 in. Vacuum		
	Velocity of Outflow of Steam, Feet per Second	Kinetic Energy, ft.-lb. per Second	H. P. of 550 ft.-lb. per Second	Velocity of Outflow of Steam Feet per Second	Kinetic Energy, ft.-lb. per Second	H. P. of 550 ft.-lb. per Second	Velocity of Outflow of Steam, Feet per Second	Kinetic Energy, ft.-lb. per Second	H.P. of 550 ft.-lb per Second
		Per lb. of Steam per Hour			Per lb. of Steam per Hour			Per lb. of Steam per Hour	
60	2,421	25.29	0.046	3,320	47.57	0.087	3,680	58.44	0.106
80	2,595	29.06	0.053	3,423	50.56	0.092	3,793	62.08	0.113
100	2,717	31.86	0.058	3,520	53.47	0.097	3,871	64.66	0.118
120	2,822	34.37	0.062	3,596	55.80	0.101	3,940	66.99	0.122
140	2,913	36.62	0.066	3,661	57.84	0.105	3,999	69.01	0.125
160	2,992	38.63	0.070	3,718	59.65	0.108	4,045	70.61	0.128
180	3,058	40.35	0.073	3,764	61.14	0.111	4,091	72.22	0.131
200	3,115	41.87	0.076	3,810	62.64	0.114	4,127	73.50	0.134
220	3,166	43.26	0.079	3,852	64.03	0.116	4,159	74.64	0.136
280	3,294	46.83	0.085	3,962	67.74	0.123	4,229	77.18	0.140

As will be seen from this table, the velocity of outflow of steam expanded adiabatically in suitable nozzles to the proper ratio is very high. Steam expanded in a nozzle from 280 lbs. pressure above the atmosphere down to 28 ins. vacuum leaves the nozzle with a velocity of 4229 ft. per second, or over 48 miles per minute. This steam jet would pass round the earth in eight hours and thirty-seven minutes.

The expansion of the steam in the nozzle is obtained by making the passage conical, the steam traveling from a smaller section in the nozzle to a larger one.

In order to illustrate the properties of a steam nozzle, we may take, for instance, one for 200 lbs. steam pressure and 28 ins. vacuum.

Supposing that the admission steam is dry, *i. e.*, that it does not contain any moisture, then at different sections, Fig. 1, the pressures, etc., will be as follows:

Section A—
Pressure 200 lbs. per square inch above the atmosphere.
Percentage of moisture, 0.
Specific quantity of steam, 1.
Section B—(the smallest section of the nozzle).
Pressure 110 lbs. per square inch above the atmosphere.
Specific quantity of steam, 0.96.
Velocity of the steam, 1500 ft. per second.
Specific volume of the steam, 3.5 cu. ft. per lb.
Section C—(the largest section of the nozzle).
Pressure (28 ins. of vacuum) 2 ins of mercury absolute pressure.
Percentage of moisture in the steam, 24 per cent.
Specific quantity of steam, 0.76.
Velocity of the steam, 4127 ft. per second.
Specific volume of the steam, 256.8 cu. ft. per lb.

The proportion between the areas of the large and small section of this nozzle should be as 27.2345 to 1, or the proportion between the diameters of these two sections as 5.2187 to 1. If, for instance, the diameter of the small section is 6 mm, or very nearly ¼ of an inch, the diameter of the large section should be 31.31 mm, or nearly 1¼ ins. Through such a nozzle there passes 479 lbs. of dry saturated steam of 200 lbs. pressure per hour, neither more nor less. This fact of the nozzle passing only a certain amount of steam per hour is often used to ascertain the steam consumption of the turbines.

As mentioned previously it is important that as much as possible of the kinetic energy of the steam jet issuing from the nozzle should be taken up by the turbine wheel, and thus transformed into mechanical energy. The angle between the nozzle and the plane of rotation of the wheel is 20 degs., and in order to obtain the maximum efficiency, the peripheral speed of the turbine wheel, *i. e.*, the linear velocity of the buckets, should be 47 per cent of the velocity of the steam. The absolute velocity of the steam leaving the buckets is then 74 per cent of the initial velocity, and the energy absorbed by the turbine wheel is 88 per cent of the kinetic energy of the steam.

If, for instance, the speed of the steam entering the buckets of the turbine wheel is 4000 ft. per second, the speed of the steam leaving the buckets should be 1360 ft. per second, and the number of horse-power per lb of steam—

$$\frac{4000^2 - 1360^2}{2g \times 550 \times 3600} = 0.11$$

and the steam consumption per theoretical horse power:

$$\frac{2g \times 550 \times 3600}{4000^2 - 1360^2} = 9.1 \text{ lbs.}$$

The steam nozzles are placed in very close proximity to the buckets of the turbine wheel, in fact the distance is only 2 mm, of about 1-16 of an inch, and consequently there is practically no loss of velocity between the steam jet leaving the nozzle and entering the buckets of the turbine wheel.

The speed of the turbine wheel, which for a velocity of the steam jet of 4000 ft. per second ought to be about 1880 ft. per second, or about 21 miles per minute, is however much lower for several practical reasons. At the present time the peripheral speed of the De Laval turbine wheel does not exceed 1380 ft. per scond. which should make a steam consumption of 9.8 lbs. per theoretical horse-power. The following table gives the speed of some types of turbine wheels:

TABLE II

Speeds of Turbine Wheels

Size of turbine	Middle diameter of wheel	Revolutions per minute	Peripheral speed feet per sec.
100 hp	500 mm, 19¾ ins.	13,000	1,115
5 hp	100 mm, 4 ins.	30,000	515
15 hp	150 mm, 6 ins.	24,000	617
30 hp	225 mm, 8⅞ ins.	20,000	774
50 hp	300 mm, 11¾ ins.	16,400	846
300 hp	760 mm, 30 ins.	10,600	1,378

* Abstract of paper read Oct. 31, 1902, before the Institution of Engineers and Shipbuilders in Scotland.

As may be seen from the foregoing table, the peripheral speed increases with the size of the wheel, and the larger the diameter the higher also is the peripheral speed. The 300-hp turbine wheel runs with a peripheral speed of 1378 ft. per second in the middle of the buckets; the outside diameter of this wheel is 800 mm, or 31½ ins., and the circumferential velocity of the wheel is 1450 ft. per second, or more than 16 miles per minute. At this speed the wheel would travel round the equator of the earth in twenty-five hours.

On account of the pheripheral speed of the turbine wheel not being so high as it theoretically ought to be, there is, particularly at high admission pressure and good vacuum, a slight impact when the steam enters the buckets. This is, however, allowed for practical reasons, and the energy due to the loss of speed by this impact is not entirely lost by the turbine, as will be seen later.

One advantage of the action principle of the turbine is that the turbine wheel can revolve quite freely in the casing. This is an essential feature of the machine, and moreover it would not be possible to run at the speed required should a tightening be necessary round the turbine wheel. The wheel does not touch anywhere, and all the steam on emerging from the nozzles must pass the buckets of the wheel, as the radial length of the buckets is always larger than the diameter of the steam jet. There is consequently no possibility of any steam leaking through the turbine, but it must of necessity pass the buckets and deliver its energy to the turbine wheel.

The high peripheral speed which, as previously seen, is necessary in order to obtain a good efficiency, has been obtained by allowing the turbine wheel to run at a very high velocity. A reference to Table II. will also show that the number of revolutions is much higher than the speeds formerly used in practical engineering.

The turbine wheel must be strong enough to stand the speed at which it is required to work, and the design and construction of this wheel are, therefore, of considerable importance. The stresses in the material of the wheel must, throughout the whole section of the wheel, be kept within the limits permitted for the material.

The wheel is made as a solid disc, on the circumference of which the buckets are dovetailed in, each bucket being made and fixed separately to the wheel. The buckets consequently load the circumference of the wheel with a radial force when the wheel is revolving. The amount of this force may be understood when it is mentioned that the centrifugal force on the bucket of a 300-hp turbine wheel, which bucket weighs 250 grains, is 15 cwts. when the wheel is running at its standard speed.

The stresses in the wheel are tangential and radial, and if we call the radial stress P and the tangential stresses S, it is evident that both P and S vary with the radius R. Further, these stresses depend on the axial thickness of the wheel in each place, and they also affect one another.

Fig. 2 shows the stresses in a wheel for a 50-hp steam turbine.

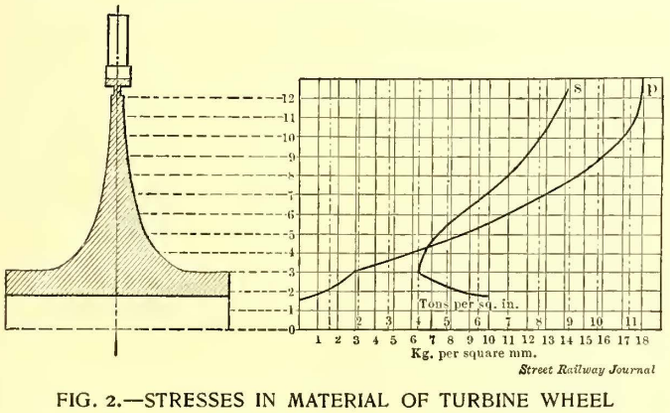


FIG. 2.—STRESSES IN MATERIAL OF TURBINE WHEEL

As may be seen by this diagram the wheel is so constructed that both P and S have their largest value at the circumference of the wheel, just where the buckets are fixed. Consequently the wheel is not made of uniform strength, but is strongest at the heaviest part, that is, in the center.

It will be seen from Fig. 2 that the tangential stresses S in the boss of the wheel increase as they approach the hole in the center of the wheel. These stresses would be still greater on the larger sizes of wheels, and in order to avoid these greater stresses the larger wheels are made without any hole through the center, but the shaft is made in two pieces fixed to the wheel by flanges and screws.

The part of the turbine which makes it possible to run the turbine wheel at its enormous speed, is the "flexible shaft." The shaft on which the turbine wheel is mounted has bearings on each side of the wheel at a good distance from it, and the shaft is consequently flexible and can allow the wheel to swing a little in its plane of rotation. No matter with what nicety the turbine wheel may be turned and balanced, it is practically impossible to bring the center of gravity of the wheel exactly into the geometrical center round which the wheel revolves. The fault causes vibrations, which, if a firm shaft were used, would increase with the speed to such an extent that the bearings would instantly be ruined. With the employment of a flexible shaft there are also vibrations, increasing with the number of revolutions of the wheel. At a certain speed, however, the phenomenon arises that the vibrations suddenly disappear, and the shaft runs smoothly in its bearings.

The speed of the wheel at which this phenomenon arises is called "the critical speed of the wheel," and the phenomenon itself is termed "the settling of the wheel." The explanation is that the wheel at the critical speed takes a new center of rotation, very near the center of gravity, the shaft springing out and allowing this to happen. The reason for this phenomenon cannot be scientifically explained, but assuming, as is very probable, that the settling of the wheel occurs when the number of revolutions is equal to the number of vibrations which the shaft makes with the wheel mounted upon it, the critical speed can be calculated, and it is found to be:

$$n = C\sqrt{\frac{P}{Q}}$$

Where P = the force required to bend the shaft a certain distance
Q = the weight of the turbine wheel,
C = constant.

This formula seems to correspond very closely with the results obtained at actual tests.

The flexible shaft and the turbine wheel are so proportioned that the settling of the wheel takes place very quickly, and the critical speed is from one-fifth to one-eighth of the standard number of revolutions of the wheel. Of course the turbine wheels are very finely balanced and the settling of the wheel is, therefore, scarcely perceptible. It is the flexible shaft that serves to transmit the power of the turbine.

The diameter of the shaft is, on account of the high speed, very small, and it is therefore easy to make it flexible. The shaft of the 300-hp turbine wheel has a diameter of 34 mm, or 1 5-16 ins., and that of the 150-hp wheel 25 mm, or 1 in.; no larger diameter is required.

The normal speed of the turbine wheel is too high for direct driving of ordinary machinery, and it is, therefore, reduced by means of gearing. This gearing is made on the double helical system, and machined with the greatest care and accuracy, as is necessary on account of the high speed. The speed of the gearing, that is the linear velocity of the teeth, is about 1000 ft. per second. The pinion is made of hard steel (in one piece with the shaft) and the teeth of the gearing wheels are cut in a somewhat softer steel than the pinion.

All the revolving parts of the turbine are most carefully balanced, and the parts mounted on the shafts are centered by tapers. The bearings of the slow speed shafts are lubricated by rings, as is usual in this class of machinery. The journals of the flexible shaft are oiled by sight feed lubricators. The bearings, which are all made as interchangeable bushes, are lined with white metal and there is practically no wear on them if the machine is well lined up and properly mounted from the beginning.

The turbines are generally fitted with more than one steam nozzle and these are arranged at intervals in a ring in close proximity to the turbine wheel, receiving the steam from a steam chest in the turbine case. Each nozzle is usually provided with a shutting-off valve so that any nozzle can be closed or opened at any time. This arrangement is of considerable advantage, as when the turbine is working at reduced load, some of the nozzles may be closed and a high efficiency of the machine maintained, even although it is not working at full load. This will be more plainly understood from the tests of steam consumption which will be noticed subsequently.

Before the admission steam can enter the steam chest and pass from thence to the nozzles, it is regulated by the governor valve, which, in its turn, is controlled by the centrifugal governor of the machine. The governor valve is a balanced double-seated valve, connected with a link motion to the centrifugal governor.

The speed of the turbine is regulated by a very sensitive centrifugal governor, mounted horizontally on the end of the gear wheel shaft. The moving parts of the governor work practically without friction, and it is, therefore, very quick and powerful. This governor is very simple, although the construction may seem peculiar, and its dimensions are very small on account of the comparatively high speed at which it works. The variation of

speed between full load and no load is nearly one per cent, the variation is from 2 or 3 per cent generally.

The standard sizes of steam turbines can work with any steam pressure between 50 and 200 lbs. per square inch, and either with or without vacuum. The only parts of the machine which have to be arranged to suit the admission pressure and the pressure in the exhaust are the steam nozzles, which have to be shaped according to the amount of expansion of the steam. The nozzles are made interchangeable—all other parts do not alter with the pressure—and the machine can consequently work with any pressure between the above limits if only the turbine case is provided with suitable nozzles. The turbine can also be arranged with nozzles for running both condensing and non-condensing. This is often very handy and convenient, particularly if the turbine drives its own condensing machinery, direct or electrically.

TABLE III

Results of tests with De Laval Steam Turbine Pumps

Type of Turbine Pump	Revolutions per minute	Height of Suction in Feet	Height of Delivery in Feet	Quantity of Water Delivered per Sec Gallons	Water H. P.	Brake H. P.	Efficiency
50 hp duplex pump coupled in parallel	1,500	16.4	16.4	63.5	37.87	50.3	0.753
50 hp duplex pump coupled in parallel. Constructed for larger head of water than the previous	1,500	16.4	29.53	46.3	38.66	48.0	0.805
50 hp duplex pump coupled in series	2,200	19.7	137.8	12.3	35.22	50.3	0.700
20 hp duplex pump coupled in series	2,315	9.84	85.3	82.5	14.27	20.0	0.713

The general opinion among engineers has been that steam turbines must necessarily use a considerable amount of steam, as the mass of the steam jet was considered too small to give a good impulse. In order to repudiate this opinion, attention is drawn to Table I. It is proved that the expansion of steam in nozzles gives the same amount of energy, ihp, per lb. of steam, as expansion in the cylinder of an engine, the problem being to transmit as much energy as possible to the principal moving part of the turbine. There is, as previously mentioned, no leakage of steam and no appreciable loss by friction in the buckets of the turbine wheel, the only loss, and one which it is impossible to avoid, is the kinetic energy of the steam leaving the wheel. This loss may, perhaps, correspond to the imperfect expansion in the cylinder of an engine, but there is in the turbine no loss of steam from cylinder condensation, as the expansion takes place continuously and the cooling surfaces are small.

With respect to the resistances in the machine, these may be divided between pure friction losses in the bearings and gearing, and the resistance of the turbine wheel. The friction losses are very small indeed, and the resistance of the turbine wheel depends on the pressure of the medium in which the wheel revolves, and also on the medium itself. If this medium is very thin, the resistance is considerably decreased, and it is, therefore, of importance that the turbines should work condensing and with a good vacuum. At 28 ins. vacuum the total resistances in the machine are about 7½ per cent for the larger sizes of turbines.

It is evident that superheating is advantageous to the turbine, as it gives the steam jet a higher velocity and thus increases the kinetic energy of the steam, and it also diminishes the resistance of the turbine wheel.

The use of superheated steam in connection with turbines has become more general in recent years. Practically, any degree of superheating can be used, as the highly heated steam does not come into contact with the moving parts of the machinery; by the time the steam reaches the chamber in which the turbine wheel revolves, it has already the pressure and temperature of the exhaust steam. In order to give some idea as to the steam consumption of the turbine when driven with highly superheated steam, I give in Table IV. some results obtained with the 30-hp steam turbine at the Polytechnical College, Dresden.

From the results of these trials, it is obvious that not only the steam consumption but also the heat consumption (in heat units per horse-power per hour), sinks with increased superheating. With constant peripheral speed of the turbine wheel and increasing superheating, the impact is increased on account of the higher velocity of the steam, but this loss is instantly transformed into heat, which raises the temperature of the exhaust steam, and thus diminishes the resistance of the turbine wheel.

The figures of the trial in Table IV. are taken from the report in the German Engineering Society's paper of Nov. 30, 1901. The turbine was run non-condensing only. Had the machine been worked condensing with, say 28 ins. vacuum, the figures obtained would have been about 50 per cent less.

TABLE IV

Tests with a 30-hp steam turbine working with saturated and superheated steam respectively.

NON-CONDENSING

Steam pressure: 7 atmospheres absolute = 88.2 lbs.
Speed of driving shaft: 2000 r. p. m.
Speed of turbine wheel: 20,000 r. p. m.

		Half Load		Full Load	
		Saturated Steam	Superheated Steam	Saturated Steam	Superheated Steam
Temperature of the steam	Centigrade	164	460	164	500
	Fahrenheit	327	860	327	932
Power developed	Metrical b. h. p	21.4	24.5	44.1	51 9
	English b. h. p	21.1	24.2	43.5	51.2
Steam consumption per b. h. p. per hour	Kilogrammes per metrical b. h. p	21.6	14.1	17.7	11.5
	Lbs. in English b. h. p	48.3	31.5	39.6	25.7
Heat consumption per metrical b. h. p. per hour in metrical heat units		14,160	11,270	11,610	9,390
Temperature of exhaust steam	Centigrade	100	309	100	343
	Fahrenheit	212	588	212	649

Blackwell's Island Bridge Plans

Plans for the Blackwell's Island bridge will be proposed by Bridge Commissioner Lindenthal along the lines indicated in the report of the commission of experts composed of Professors Burr and Ricketts and Henry W. Hodge, and it is expected that all the details will be finally determined by July 1, 1903, which is the earliest date upon which bonds for this improvement can be issued. The commission proposes that a bridge 91 ft. wide be designed to take the place of the original plan and of the plans suggested by Commissioner Lindenthal. This is 29 ft. narrower than the original plan, and 11 ft. wider than the bridge commissioner's plan. The general arrangements of the new bridge will resemble in the main those of the commissioner, but they will be like those of the original plan, in giving to all the trolley tracks lanes of their own, instead of laying one pair of tracks on the main roadway. The feature of a wide free roadway, undivided by columns, suggested by the bridge commissioner, is, however, retained. The bridge is to be widened from 80 ft. to 91 ft. in order to permit the good features of both plans to be secured as to the arrangement of trolley tracks and roadway.

The entire subject of design and construction of the Blackwell's Island bridge, together with all the suggestions that had been received by the city administration, had been referred to the commission by Mayor Low for examination, and the report submitted last week is the result of this investigation. In answer to the query of how the capacity of the bridge proposed by Mr. Lindenthal compares with the capacity of the bridge as originally planned, whether it is larger or smaller, or substantially the same, the commission reports that the total aggregate capacity of the original plan is greater than that of the proposed one. It is explained that the two remaining trolley tracks in the original design are entirely separated from the roadway traffic, hence the capacity of the trolley service in the original design is greater, as no lines can be delayed or detained by the wagon traffic.

In comparing the efficiency of the designs the commission considered the following characteristics: Superiority in handling traffic; the facility with which passengers may take other means of transportation in cases of accident; the possibility of accident due to any arrangement of the passageways for different kinds of traffic; the attractiveness of the various lines of traffic for the purposes for which they are intended; the general arrangement of the members of the bridge trusses and floor system to insure the greatest rigidity and durability.

In concluding, the commission recommends that "two sidewalks, each not less than 11 ft. in clear width, be placed on the upper deck inside of the trusses and adjacent to them; that the two lines of elevated railway be placed on the upper deck, one on each side of the center line and as close as possible to the sidewalk; that the lower deck be arranged with two trolley lines in overhanging brackets, one outside of each truss, and with two additional trolley lines inside of the trusses, one line being adjacent to each truss, and that a roadway be placed in the middle of the lower deck, with complete separation between it and the trolley lines on either side."

It is further the judgment of the commission that the capacity afforded by this plan is not beyond reasonable provision for the future requirements of the locality served by the bridge.

Efficient Discipline

In the STREET RAILWAY JOURNAL for Nov. 29, three papers on the subject of discipline for railroad employees, read at the Nov. 21 meeting of the New York Railroad Club by Messrs. Wheatly, Slingerland and Ketcham, were published. A fourth paper on the same subject read at the same meeting of the club by T. E. Mitten, general manager of the International Traction Company, of Buffalo, was published in the issue of Dec. 6. Remarks were also made on the subject by Prof. Hibbard, of Cornell University; C. W. Bradley, of the New York Central Car Service Association, and George W. West, superintendent of motive power of the New York, Ontario & Western Railroad Company. Abstracts of these remarks follows:

REMARKS BY PROF. HIBBARD

These remarks have special reference to the details in the training of subordinate officers in shops.

Always have someone in mind who would fill each man's place if necessary. Gang leaders, and especially foremen, should be selected with the utmost care. Outsiders (new blood and methods) are occasionally preferable to promotions; but as a rule they should not be brought in unless absolutely necessary. Watch out for and promote good men. Keep your eye on the man who does far more and better than he is paid for or is expected to do. The natural leader may show his qualities in his development, in his desire to do his work in newer, better ways, keeping ahead of the others and showing them the way. A good foreman must not only be able to systematize work, laying it out and so keeping his men busy, but also be able to "manage" men. Find from subordinate officers whom they consider their best men, and watch them. But favoritism, jealousy, or personal dislike may bias subordinate officers. If it be decided, finally, to promote a man contrary to his foreman's judgment, put him in a different department until he has proved his worth. Always stand by those selections which have been justified by observation and experience. Uphold authority of all your subordinate officers when in the right. Train them not to make important decisions which will become precedents, without first consulting you. Never, under any circumstances, reprove them in presence of their men; there may be some criticism or requst for explanation regarding work on the spot, though not to be heard by the men; but reserve all severe criticism for the private office. Never disparage one foreman when talking to another.

Have outlined a proper channel for complaints; complaints against a gang leader to be made to a foreman as a rule, not to the master mechanic—but let it be thoroughly understood that there is always the right of appeal to a higher officer. Be willing to revise a subordinate officer's overzealous, hasty or wrong decision, but with great tact and caution. A good plan, at least in small disputes where a workman feels himself unjustly treated, is to get the foreman and man together and then with careful study of the question you can show one or both where they have been too hasty; there should result voluntary acknowledgment of the mistake. If men's complaints are upheld by the master mechanic, foremen should understand that they should have removed the causes before the men reached the complaint stage. A subordinate officer will be more likely to refrain from unjust acts if he knows that the man will get a fair hearing on appeal to the master mechanic. Subordinate officers should be given to understand distinctly that no man shall be persecuted for having appealed.

Keep in close touch with all subordinate officers. They should all understand your desires thoroughly and be absolutely loyal in carrying out the spirit of your laws. Assemble regularly the foremen of all departments, with the storekeeper and general foreman, into the office of the master mechanic, with a stenographer. Occasionally take probable future foremen into the meetings, which not only gives them some training, but results in the leading workmen having more insight into the problems of official management. After the general and detailed statements of conditions of work, stock, delays, etc., have been discussed, take up the subject of complaints, dissatisfaction and discipline of the men. In order to save time, it is well to have your secretary notify each one as to the disciplinary topics to be considered, so that all may come prepared. Avoid any personal naming of a weak disciplinarian in meeting. Talk to such an officer alone.

Hold subordinate officers responsible for what their men do. Hold foremen responsible for what their own subordinate officers do. Under most circumstances, if an officer is held responsible for "results" of his subordinates he should be given subordinates satisfactory to himself. Under officers should be encouraged to ask advice from superior officers without such asking giving the impression that they lack decision or have a desire to shirk responsibility for their later action. It will need some tact for the superior officer to prevent his advice from being considered mandatory.

Foremen never should be late; the master mechanic should be on hand early, occasionally, at the spot where a foreman should be. Officers should transact shop business with the proper subordinate officers, not with the men under them. All officers must sustain cordial shop relations with each other. It is the duty of a superior to correct the first sign of discord among inferior officers. Unfailing courtesy at all times by officers towards men is demanded; this does not prevent severe language when possibly needed. A foreman should analyze the discipline failures and successes of himself and other officers. Avoid that undue "familiarity" with the men outside which " breeds contempt" and lessens their respect, though having sufficiently rugged personality to permit judicious mingling with them without harm, getting their good will and keeping on good terms with them and being yourself approachable. It is easy to invite or repel familiarity by one's manner. In the shop avoid any familiarity with any "pets."

Get out of an officer's head the idea that he is any better than his men. Possibly only the accident of opportunity has placed him above them in control; a number of them might do better than he if in his position. All officers should be neat and clean in person. Often it is necessary for them to get dirty, but they should not stay dirty. A small monthly prize, and, of course, verbal commendation, will stimulate foremen to try to have the cleanest department without increased labor cost.

New foremen should not be too quick to institute needed changes by wholesale and prompt overturning of customs. First let him get quietly and thoroughly acquainted with all sides of the situation and the men. If the methods of work need to be speeded up all around, let him do it gradually, possibly with only one workman at a time, thus avoiding united opposition. Keep close watch of the shop, inspect daily and oftener. Know in a general way about how much work each man, gang and department ought to do, with close enough knowledge to be able to keep the foremen up to limits; the details must, of course, lie with them.

An officer should have the ability to unload work and responsibility upon his subordinates instead of trying himself to do things in detail and routine work, training his subordinates to be increasingly efficient, and thus to set free more of his time for attention to further and new matters pressing for solution. Proper arrangement of work to each subordinate will enable that subordinate to get his work thoroughly in hand and to present such reports to his superior as to enable the latter to understand difficulties at once and solve them without waste of time. An officer is judged by the assistants he gathers around him. Later on, these "understudies" will be ready to take up his work if he is laid aside.

Have a manly, unpatronizing, unpaternal, yet sympathetic application of the Golden Rule, "Do unto others as you would have them do unto you."

REMARKS OF MR. BRADLEY

I must take exception to Mr. Ketcham's idea that a man once discharged should never be re-employed. I am not a believer in the theory that "the King can do no wrong," nor in the divine right of the railroad official to brand a man for life for an error he may have committed, or a mistake he may have or may not have made. All of the papers referred to tell us what discipline is, what to do and what should be done. They do not, however, tell us how to do it. They have stuck to the text literally—"Efficient Discipline."

I will try, with your permission, to enlarge the scope of the inquiry and deal with the broad question of railroad discipline—for how to do it. First, however, let us consider the discipline in the regular army.

The regulations for the army of the United States, Article 1, is headed "Military Discipline," and reads:

1. "All persons in the military service are required to obey strictly and to execute promptly all lawful orders of their superiors."

2. "Military authority will be exercised with firmness, kindness and justice. Punishments must conform to law and follow offenses as promptly as circumstances will permit."

3. "Superiors are forbidden to injure those under their authority by tyrannical or capricious conduct or abusive language."

4. "Courtesy among military men is indispensable to discipline. Respect to superiors will not be confined to obedience on duty, but will extend on all occasions."

[NOTE:—Courtesy is extended so far that an officer, no matter how high his rank, returns the salute of the private.]

Article XXV. of the regulations for the army of the United States is headed, "Medals of Honor and Certificates of Merit," and reads:

177. "Medal of Honor will be awarded to officers and enlisted men who distinguish themselves in action."

178. "When an enlisted man of the army shall distinguish himself in the

service, the President may grant him a certificate of merit on the recommendation of the commanding officer of the regiment, or chief of corps to which the man belongs."

180. "Extra pay from the date of the distinguished service is allowed each enlisted man to whom a certificate of merit is granted."

How is it in the railroad service? Is there that comradeship and courtesy between the railroad officials and their subordinates, as a rule, that there is in the army? Courtesy begets courtesy. Discipline grows with what it is fed on. Fair dealing begets good, loyal service, and the test of efficiency is results.

General Sherman in his memoirs says: "No man can properly command an army from the rear. He must be at its front, and when a detachment is made, the commander thereof should be informed of the object to be accomplished and left as free as possible to execute it in his own way; when an army is divided up into several parts, the superior should always attend that one which he regards as most important. Some men think that modern armies may be so regulated that a general can sit in an office and play on his several columns as on the keys of a piano. This is a fearful mistake. The directing mind must be at the very head of the army, must be seen there, and the effect of his mind and personal energy must be felt by every officer and man present with it to secure the best results."

The railroad officer who sits in his office and plays on his men as on the "Harp of a Thousand Strings," with long, windy, typewritten, nagging letters and telegrams to his subordinates, does not encourage good service or produce the best results. He may have efficient discipline, but he will not secure the loyal, earnest support of his men. At the present time, when every yard east of the Rocky Mountains is congested, how many of you—you operating officers—have spent a whole day or two whole nights on the ground to know, actually know, for yourselves just the condition, and by your prescnce in the field assisted in raising the blockades? Don't some of you play golf days and work the telephone nights? Would not a little of the discipline you are giving your men, applied to yourselves, help the situation?

To my mind an officer who is always on deck, who is fair and square in dealing with his subordinates, one who strikes from the shoulder, never "below the belt," one who makes good every promise to his men, whose word is as good as his bond, gets the best results. He never has any trouble in getting his orders, rules, instructions and wishes carried out; but the officer, no matter what his position, who is not a manly man and who does not treat his men like men, will not get good service, discipline as much as he may, by fine, suspension or discharge. They will hate him. They can't help it, and will "best him" when they can. The average railroad man knows about as much about the service as the average railroad officer does.

I must again quote old Sherman. He says: "I have many a time crept forward to the skirmish line to avail myself of the cover of the pickets' 'Little Fort' to observe more closely some expected result, and always talked familiarly with the men and was astonished to see how well they comprehended the general object and how accurately they were informed of the state of facts existing miles away from their particular corps. Soldiers are very quick to catch the general drift and purpose of a campaign, and are always sensible when they are well commanded or well cared for."

Is not this condition General Sherman speaks of in the army absolutely true in the railroad service? Do we in the railroad service get that recognition for a meritorious act, or acts, as is the case in the army? If we do, it is so infrequent that we seldom hear of it. On the contrary, let anything go wrong, any failure to live up to or to carry out some of the many rules that cannot, never have been nor ever will be carried out, made to shield the inefficiency and incapacity of the officer, and it is instantly heralded from one end of the road to the other. The man is discharged, discipline enforced. The officer's conscience is clear. He has done what the rulcs prescribe. He has done his duty as he sees it.

Take an instance like this: A freight conductor gets a telegram which reads something like this:

"To John Doe:

Report at my office at ten o'clock sharp to-morrow morning.

(Signed) Supt."

This message is received, say at 6.00 p. m. "J. D." takes a night train, sits up all night, rides 100 or 150 miles and calls on Mr. Superintedent at ten o'clock sharp. This is what occurs:

Superintendent: "You were conductor of the way-freight yesterday?"

John Doe: "Yes."

Superintendent: "You know I issued an order that the doors of freight cars should be closed and kept closed?"

John Doe: "Yes, sir."

Superintendent: "Well, sir, I noticed a box car in your train yesterday with a door open at ——— station. Don't let this occur again. Go back and take your train, sir, but this must never occur again. Never! Do you understand? Not another word, sir."

John bows himself out, indulges in more or less silent profanity, goes back home, takes his run, having lost his pay for one round trip and is hot under the collar for the next two weeks. Mr. Superintendent says to himself: "Mr. Doe now knows that orders are orders. 'Efficient Discipline.'"

Take another similar case: A different type of a superintendent, who notices an infraction of the rules or orders and makes a note of it, and the first time he sees John he calls him to one side, perhaps it is in the yard or out on the road, and says, "John, you are as much interested, or should be as much interested, in the success of this road as I am. We are both servants of the company and in our respective positions are responsible for our acts. This rule is for the best interests of the service, and I want you to help me enforce it."

What is the result? John is pleased, his manhood has not been attacked. He feels he is a man, a man among men. He tells all "the boys," his comrades in the service, what has been said and done, what rule he violated, and says to his comrades: "The old man is just right. I did not lose any time as Bill Jones did on the Pee Wee road, and you bet your bottom dollar I am going to do my very level best to enforce the rules of the old man in future, and I am going to see that you do it, too." This picture is not overdrawn. Now, which is the better plan? The first or the second?

You all perhaps recollect the incident that occurred at Montauk Point one Sunday on the return of our brave boys from Cuba at the close of the late war with Spain, when President Roosevelt was asked how he felt leading his men in the charge on San Juan Hill. The Colonel, after apologizing for what he was about to say, made this reply: "I did not lead; I had to run like hell to prevent being run over by my men." If "Teddy" had been made up on the lines of the first superintendent, just referred to, or had he remained in camp and "played on his men as on the keys of a piano," would his men have done this? Not much! You would have had to drive them in this charge, and don't you forget it.

The point I make is this: To produce the best results, begin your efficient discipline, like charity, at home. Discipline yourselves and give your men the same loyal, earnest support you expect from them. Go to the front yourselves. West Point does not make the successful commander unless the man has the stuff in him to command, and this faculty of command over men comes from a higher power than the cadet gets during his four years' tuition on the banks of the Hudson.

There is another phase of this question of "Efficient Discipline" in the railroad service, and that is, the uncertainty of the tenure of office. How many of you who are present here this evening know, know absolutely, that you will not find a blue envelope on your desk in the morning, the contents of which may read somewhat like this: "Dear Sir—Regretting the necessity, but duty compels me, for the good of the service, to ask for your resignation to take effect ————, Respectfully, etc." How many of you have been there? And how often have you seen a change in the executive at the head of a road or a system followed almost immediately by a change of every subordinate official in every department? No reasons stated, nor any explanations given.

Do the men who are thus "bounced" get off the earth? Do they sink out of sight? Are they lost to the railroad world? Not much! In many cases they are re-employed elsewhere with increased responsibility. Some of the older men, however, I regret to say, are turned out like an old army mule—to eke out his last days as best he can. I am glad to say, however, that there is not as much of this wholesale slaughtering to-day as has been the practice in the past. Cannot the tenure of office in the railroad service be made more permanent? The same kind of executive tact, skill, energy and ability is required in the railroad service as we demand in the army. How long would your army last, and what kind of efficiency would be shown in the army, or in the navy, if it were possible with a change in the administration at Washington to be able to discharge every officer above the rank of a corporal? The railroad man devotes his best years to the service.

REMARKS OF MR. WEST

I agree with Mr. Bradley in the stand he has taken in regard to discharged employees and think this ruling is one of the worst enemies to good discipline that can be adopted. My reasons are as follows:

In the first place, the only object of punishment for any offense should be to better the man and the service. I do not think anyone would care to say they had any other object. My experience

in handling men for twenty-five years has convinced me that there are three classes of men in railroad service that produce bad results, or need what is commonly called disciplining.

First, a class that get into all departments the same as they get into churches, lodges and clubs that never belonged there and should never have been taken in. This is the hardest class to handle. The best way to do it is by giving the man in charge of the men he works with, authority to dismiss men, subject to what I may say hereafter.

Second, the class of men that is best expressed in the slang phrase, "playing in hard luck." I am fully aware we have a lot of men holding positions in railroad work that will not admit there is anything in luck, but let these same men hold a position at a card table where they are winners and ask them to change seats and see if they will do it; or in any game of chance, if they find a number with which they are successful, how they will hang to it as "lucky!" I have known a lot of well-meaning men in my life that for a time were unfortunate; an unfortunate man must be treated the same as an incompetent one, for the results are the same to any company, but the chances are that if these same men went on another road and gave satisfactory service, they could come back to their home road and make good men. I have known several men treated in that way that could not be beaten.

I have spoken of two classes of men as I find them in railroading, and have mentioned three. The other class are they that know how, but will not, and I am sorry to say this class is growing in numbers.

On some men one blow has as much effect as one hundred, and a trip or two, or a week's suspension, would be better than a month; for if the man was worth holding, a short suspension would humiliate him, while a long one would make him ugly, and this is my prime reason for saying a discharge that carries with it "never to be taken back" is wrong.

Men do things in all branches of business that demand more severe measure than a suspension of one week or even two, on a book full of demerit marks, and something more severe than demerit marks, or light suspensions, will have to be dealt out to such a man. When a man from any cause had his records filled with demerit marks or suspensions, I would call him to the office, tell him his record had been bad, and the best interest of us all demanded his discharge; but I would never lock the door securely against an erring child or a man whether I wanted him back or not. I would have him feel the latch string held out for him and that he was sent away to better fit him for his work. Let him have this to encourage him to be a good man for someone else if he could not for us, but if he merited it he could have the same chance some day same as a new man to return to his home road. There are some roads and some officers that discharge men that I do not believe ever have any discharged employees asking for re-employment. They find better and more congenial people to work with.

We ought to encourage men to build homes and take an interest in building up the towns and layover places along the road. Make it an object for them to remain with the company. Do this and there will be little use for the rod. Nothing, in my opinion, helps more to keep in line the men that remain with the company than to receive letters from discharged employees that have found a position elsewhere, saying it is not as good as the one they left, and that they would gladly come back to their old road and among the old employees if they were permitted to do so. This one influence alone is, in my opinion, sufficient to leave the gate unlocked that was closed to them when dismissed from the service.

Insurance and High Voltage Circuits

The National Board of Fire Underwriters last week discussed the subject of increasing the rate of insurance on property along streets through which high-tension transmission lines were carried, and where overhead trolley feeders were run in close proximity to the buildings. It was suggested that all insurance on this class of property be cancelled, but this measure was not received with approval by the conservative element. One member pointed out that a denial of insurance to such risks would be almost revolutionary in the insurance business, and that property usually of the highest value on principal streets, where there are overhead trolleys, would be without insurance. The property values so affected amounted to hundreds of millions of dollars. In Greater New York all the boroughs with the exception of Manhattan would be affected, and Brooklyn most heavily, because of the overhead trolley wires. Another advocate of stricter measures suggested that the rule might be applied to narrow streets only; that when the roadway was broad and there were lawns in front of the buildings, such severe measures would not be required, as there would not be the danger to life and property that existed in narrow and crowded streets.

The matter was referred for consideration to the electrical committee of the Underwriters' National Electrical Association. The report will be printed and sent to the members of the association and its affiliated bodies for consideration, pending action to be taken at a future meeting.

A committee composed of A. E. Kennelly, L. A. Ferguson, O. G. Gossler, F. A. C. Perrine, C. P. Steinmetz, Arthur Williams and C. J. H. Woodbury, has represented the American Institute of Electrical Engineers in several conferences with the insurance interests, and it is now engaged with the Underwriters' National Electrical Association in formulating rules respecting extra high-voltage lines. At a meeting of the board of directors of the Institute Dec. 8 a joint report was considered, but owing to the opposition to the proposed rules in their present form that had developed, it was decided to withhold approval until a further hearing could be given the interests opposed to these regulations. Accordingly, on Dec. 9 President Scott, of the Institute, and Dr. Kennelly, chairman of the committee on national electric code, appeared before the Underwriters' National Electric Association and presented resolutions which had been adopted by the board of directors of the Institute, with an explanation of the position of the latter body. Upon motion of C. M. Goddard, chairman of the conference committee and secretary of the Underwriters' National Electric Association, that body acquiesced in the position taken by the Institute.

The New Washington Street Subway at Boston

The Boston Transit Commission and members of the Massachusetts Railroad Commission held a meeting last week at which preliminary plans for the new Washington Street subway were discussed. The Transit Commission has power to build two separate subways with independent stations, or one subway above another with or without physical connection, and using the same stations. So many problems have arisen in connection with the work that it will probably be some days before the route will be definitely decided. One of the most important questions is the uniting of the new subway or tunnel, or both with the existing subway and elevated lines.

Approximately, the boundaries of the district within which the new subways may be built are from the Pleasant Street terminus of the present subway down Tremont Street to Scollay Square, thence to Bowdoin Square, then straight to the corner of Causeway and Leverett Streets, then along Causeway to Washington Street north, then in a straight line to the corner of State Street and Atlantic Avenue, then up State Street to Broad, thence to the telephone building on Milk Street, thence to the corner of Kingston and Essex Streets, and from this point describing a circle to the point of beginning, making the farthest possible limit the corner of Washington and Florence Streets. This area is much larger than is generally interpreted by the public, who usually consider the subway as under, or neraly under, Washington Street. Under the limits of the act the commission may exercise its own discretion about the connections of the new subway and tunnel, so that it may be decided to build the elevated car subway line from the present Castle Street junction under Washington Street to a connection with the East Boston Tunnel and the Scollay or Adams Square lines, and the subway for surface cars from Castle Street or Harrison Avenue through Chauncey and Arch streets past the Post Office, and thence through the north end to Causeway Street, or vice versa. That the two subways will be separate appears to be the view of the majority of the members of the commission at present. About $1,500 has already been expended in preliminary work. Borings have been made to determine the character of the subsoil under Washington, Arch and other streets where the subway may run, and a field party has been put at work to survey and test the foundations of the buildings in the district which may be affected by the construction of the new subway and tunnel. Each of these new underground thoroughfares will have double tracks, and it is reported as cheap to build them separately as to construct a double-deck subway. The matter of cost will, however, be subordinated to public convenience. Contracts will probably be let as soon as the preliminary work is finished, and construction work actively pushed in the early spring of 1903. Although the commission has an additional year in which to begin the construction of the subway for surface cars, it will probably be started at about the same time as that for elevated trains.

Upon the completion of the new subway there will be three underground rapid transit trunk lines traversing Boston's business district from north to south. The value of these six tracks

can well be appreciated by all railway managers whose traffic is unfortunately concentrated upon a single pair of tracks, and who are thus dependent upon the absence of collisions, fires, breakdowns or other troubles for the maintenance of a uniform and satisfactory schedule.

Electric Railways in Pennsylvania

Isaac B. Brown, superintendent of the State Bureau of Railways of Pennsylvania, has just transmitted to Governor Stone the annual report on the railways of that State. That part of the report devoted to the electric railways deals with capital stock, funded indebtedness, liabilities, assets, cost of construction and operation of the ninety-seven corporations in the State. The total capitalization, as indicated in the report for the year ending June 30, aggregated $60,698,238; the funded indebtedness, $36,773,200; the gross income, $29,001,741; the mileage, 2175. In the report Mr. Brown says:

"It is hardly possible that there is much in the financial development of street railway enterprises that can contribute very much to the financial credit of the State.

"The wildest schemes of capitalization have characterized the proceedings of many street railway corporations in their organization, in their management, in their consolidations, in their mergers and in their reorganization until we have a condition which shows that the capitalization of street railways in Pennsylvania is more than double the reported average cost of road and equipment of the steam railways in the entire United States.

"If that should be questioned, the comparisons of the capital stock outstanding and the bonded indebtedness among street railway corporations in Pennsylvania similarly located will show that one company may have many times the amount of capital stock and bonded indebtedness outstanding that another corporation has which has been constructed and maintained under similar conditions.

"From a fairly close observation of these transactions in recent years, it must be apparent that the bonded indebtedness outstanding more than equals the cost of these roads and their equipment, from which it follows that, in many cases, at least, there was little, if any, cash actually invested in the stocks.

"In some of the New England States the issuance of bonds and stocks is done under public supervision for a bona fide consideration —actual payment of cash for stocks and bonds, dollar for dollar. The result of such public supervision in the affairs of these States is that when one is offered a bond of a street railway company, or of the corporations subject to public supervision, he may rely upon the bond as a thing of value, and generally as a good investment.

"Should there not be such supervision established in the State of Pennsylvania by our Legislature?

"There can be only one answer to that question: The general good of the Commonwealth demands it. It is fair, it is honorable and reasonable that public corporations, which perform public functions by virtue of their charters, given by the State, should deal fairly with the public, both in their operations and in their financial transactions, to the end that stocks and bonds should not be given away or placed upon the market, or given to corporation officers or to individuals except for value received.

"Sooner or later there will be a consensus of opinion on the lines herein suggested, and the sooner the legislative and executive branches of our State government arrive at a point where on all sides it shall be conceded that public supervision over the financial affairs of at least railway corporations and many other corporations whose functions are purely public, the better it will be for all concerned."

Concerning the dividend feature of electric railway corporations, it said:

"As indicated, the business of operating street railways does not seem from the returns made to resut in great dividends to stockholders, and yet, possibly, if the exact amount of cash that has gone into the construction of street railways could be known, it might appear that even the small amount of dividends paid would be a fair sized rate of dividends on the actual cash capital so invested."

Taking up the subject of capitalization the report said that the aggregate capital of the ninety-seven corporations on June 30 was $60,698,238, as against $108,676,774 last year. The discrepancy, it was explained, was due to the fact that several large concerns had been absorbed and had become subsidiary. No reference was made to the Philadelphia Rapid Transit Company, which took control of the Union Traction Company and its leased lines in this city, because the Mack corporation did not formally assume the management until July 1. Operating companies with large amounts of outstanding stock included the Conestoga Traction Company, $4,000,000; the Harrisburg Traction Company, $2,000,000; the Lehigh Valley, $2,654,000; the Pittsburgh Railways Company, $5,000,000; the Scranton Railway Company, $3,000,000; the Wilkesbarre & Wyoming Valley Traction Company, $5,000,000, and the Union Traction Company, of this city, $10,500,000.

Of the total funded debt of $36,773,200 the Lehigh Valley Traction Company had $3,000,000; the Pittsburgh Railways Company, $4,579,000, and the Scranton Railway Company, $3,000,000. The total liabilities aggregate $15,698,575, making a total of capital and liability of $112,770,013.

The cost of road (by construction, purchase and lease) was given as $61,647,864, and the cost of equipment $12,015,828. The stocks owned by the various operating corporations were $21,932,440; bonds, $433,992; cash and current assets, $13,160,552; other assets, $7,013,805. The largest owners of stocks were the Harrisburg, Lehigh Valley, Pittsburgh & Scranton Companies. The Union Traction owned $5,202,412.

Under the income report the gross receipts were $29,001,741. Two of the concerns named were the Pittsburgh Railways Company, $3,711,003 (for a part of the year), and the Union Traction Company, Philadelphia, $14,006,915.

The item of disbursements was an interesting part of the report. The payments, aggregating $28,823,494, included operating expenses, interest, rentals and dividends. The operating expenses were $15,024,899, and $1,574,084 was paid in taxes. This comment was made: "In some cases the amount of taxes paid was very insignificant, considering the value of the property." The heaviest taxpayers were the Union Traction Company, $903,842; the Consolidated, of Pittsburgh, $107,092, and the United, of Pittsburgh, $58,214. The interest paid on funded indebtedness amounted to $3,065,524, of which the Union Traction paid $342,235. The rentals were $7,320,656. The underlying companies leased by the Union Traction absorbed $5,344,550, or more than five-sevenths of the whole sum. The Pittsburgh Railways Company paid $940,487.

The dividends paid by the eighteen operating corporations which declared them amounted to $1,086,440. The companies were: The Altoona & Logan Valley, $41,535; the Chester Traction, $20,000; the City of Altoona, $20,000; the Consolidated, Pittsburgh, $360,000 the Delaware County & Philadelphia, $21,000; the Harrisburg, $100,000; the Holmesburg, Tacony & Frankford, $21,000; the Johnstown, $18,000; the Lebanon Valley, $11,000; the Lehigh Valley, $95,181; the Tamaqua & Lansford, $10,000; the Roxboro, Norristown & Chestnut Hill, $46,624; the United, of Pittsburgh, $75,000; the United, of Reading, $20,000; the Wilkesbarre & Wyoming Valley, $212,500; the York, $7,000; the York & Dallastown, $6,600, and the York & Dover, $1,000.

"From these figures," declared Superintendent Brown, "it would seem that the prodigious amount of money that appears to have been made on street railway construction and operation within the last ten years must have been derived through some other sources than dividends."

MILEAGE OF COMPANIES

The companies with the greatest mileage were the Conestoga, in Lancaster County, 83 miles; the Lehigh Valley, 130; the Pittsburg Railways, 318; the Union Traction, Philadelphia, 334. The cars in use were 7017, of which 1541 were in Pittsburg and 3205 here. The employees numbered 17,788, with a compensation of $10,394,401. The Union Traction Company paid $4,466,848, or $584 to each employee. The passengers carried were 640,076,370—60,000,000 more than in 1901.

Regarding accidents, 34 passengers and 11 employees were killed. The accidents to passengers numbered 1466, as against 1050 in 1901; to employees, 234, as against 129. The number of persons not passengers or employees who were killed was 141; injured, 906. It was presumed in the report that the death of persons other than passengers and employees was due largely to carelessness. Reckless operation and high speed were blamed for many accidents, and the report dealt severely with these things.

The "great velocity" at which the cars were run, according to the report, did not apply to Philadelphia, but Mr. Brown declared:

"It is alarming to witness in some instances the speed at which the cars are run, the velocity being almost equal to that of express trains. Such speed is not essential to proper service. It only invites accidents.'

It was suggested that high speed, especially down street grades, should be prohibited, and that the "utmost care" should be exercised in handling cars. "If railway managers will not prohibit by most stringent rules and regulations the prevailing recklessnes which is found in some localities," continued the report, "it will not be long before some provision will be made by which the State will exericse a just authority."

The report concluded with a reference to ninety-six subsidiary corporations which made reports to the Department of Internal Affairs. Their capital stock outstanding aggregated $119,801,319, with a funded and unfunded indebtedness of $62,921,719. The income, principally from rentals, was $7,555,102, and dividends of $4,893,020 were paid.

"These figures," said Mr. Brown, "representing the financial and physical conditions of street railway companies, are the result of the rapid transition from conditions that existed a few years ago to those now prevailing, which have been brought about largely through the introduction of electricity as a motor power.

"Probably in the history of financial affairs in this State it would be difficult to find more rapid strides in the financial development and in the introduction of new devices, appliances, means of operation and maintenance than can be found in the history of street railway enterprises in the period of ten or twelve years."

Transit Improvements at Pittsburgh

The report of the committee appointed sometime ago by Recorder Brown, of Pittsburgh, to consider measures of relief for the traction situation, has been made public. The report is presented by William McConway, H. C. Frick, A. W. Mellon, Col. A. J. Logan and Reuben Miller, and, as the Pittsburgh Times says, is rendered to offer suggestions for bettering a service that is wholly inadequate, but for which the operating company is not responsible, as the conditions that now exist are the result of the rapid growth of a prosperous community in a territory where hills preclude the possibility of many wide streets. The commission offers two schemes. One, for immediate relief, suggests the occupation of a number of streets not now traversed, and advises on the change of many of the downtown loops, and the other provides for the permanent relief.

The plan for temporary relief provides for a line on Liberty Avenue as a base line, the north side and west end cars not to pass south of it, and east end cars not to pass north of it. Then there is presented in detail a plan for downtown loops, to prevent the overcrowding of any one street, and then a crosstown line from Sharpsburg, by way of Highland Park to Oakland and Soho and across the South Twenty-Second Street Bridge is proposed. Transfers on all divisions are recommended. For permanent relief an elevated railway along Liberty Avenue to the forks of the road, a high bridge over the Panhandle tracks in Try Street, and the occupancy of all downtown streets by surface lines, including Diamond Street and Virgin Alley, are proposed. Other large plans are left for further consideration. Recorder Brown has offered the following recommendations, which have been accepted by the commission: Elevated line from Lawrenceville to Bellefield; elevated line from Ferry and Water Streets, out Second Avenue, to Glenwood; elevated line from Second Avenue in Soho, through Oakland to Bellefield, to form a crosstown line with the first road.

The Pittsburgh Railways Company, which controls all the lines in the city, did not come into control of the various independent properties until Jan. 1, 1902, so will not complete the first year of its existence until Dec. 31. The various properties that it took over, independent but complete in themselves, were not, of course, laid out so as to operate to best advantage or economically as a whole. And in addition to its work of simplification and readjustment, the company found itself called upon to haul about 20,000,000 more passengers than were earned by the individual companies during the previous year. The unification of the operating forces, readjustment of power distribution, and the myriad of other problems that had to be met at once necessarily made impossible changes in the physical properties such as relocation of lines, etc. Even an increase of over 15 per cent in the carrying capacity of the company afforded but little relief.

Railway Taxes in Connecticut

As a result of the meeting of the State Board of Equalization, at Hartford a few days ago, the accountants in the Treasurer's office have made out and notified the several steam and street railway corporations of the State of the amounts of taxes due by each. The total amount is $1,284,313. Of this large sum $1,032,173 will be paid by the steam roads, and $252,140 by the street railway companies. As usual the New York, New Haven & Hartford Railroad and its leased lines pay nearly all of the steam road tax.

Of the street railways the Connecticut Railway & Lighting Company and its subordinate lines pay the largest tax, $84,522. The Fair Haven & Westville, of New Haven, is the second largest taxpayer, and the Hartford Street Railway Company the third. The smallest taxpayer is the Newington Tramway Company, which is called upon to contribute exactly 8 cents to the State Treasury. The amounts to be paid by the several street railways are as follows:

Branford Light & Water Company, $1,700.14; Connecticut Railway & Lighting, $84,522; Danielson & Norwich Street Railway, $505; Danbury & Bethel Street Railway, $3,041; East Hartford & Glastonbury, $2,000; Fair Haven & Westville, $52,862; Farmington Street Railroad, $781; Greenwich Tramway, $3,324; Hartford & Springfield, $5,400; Hartford Street Railroad, $38,801; Hartford, Manchester & Rockville, $4,299; Manufacturers, of New Haven, $210; Meriden Electric, $6,239; Meriden, Southington & Compounce, $2,335; Middletown Street Railroad, $1,581; Montville Street Railroad, $5,000; New London Street Railroad, $3,365; Norwich Street Railroad, $5,340; Newington Tramway, .08; People's Tramway, Danielson, $5,542; Somers & Enfield, $50; South Manchester Light & Power, $100; Stamford Street Railroad, $2,210; Suffield Street Railroad, $730; Torrington & Winchester, $2,015; West Shore, New Haven, $940; Winchester Avenue, New Haven, $17,154; Worcester & Connecticut Eastern, $507. Total, $252,140.

The Lease of the Indianapolis Street Railway

A report from Indianapolis says that official announcement has been made that the Indianapolis Traction & Terminal Company will, at once, propose to lease the Indianapolis Street Railway Company's lines for thirty years, the length of the franchise of both, and will, if the proposition be accepted, issue $5,000,000 stock and $5,000,000 bonds. Of the stock, $1,500,000 will be distributed to the stockholders of the street railway company as a bonus, and a fixed graduated dividend on the street railway stock will be guaranteed from the date of the signing of the lease. The Terminal Company has a franchise and a contract with all the interurban roads and will erect in a few months a station costing $1,000,000. The stockholders will, it is believed, accept the lease.

Pennsylvania Tunnel Franchise Passed

The New York Board of Aldermen has acted favorably upon the Pennsylvania tunnel franchise, and the improvement is now assured, as the terms of the grant are satisfactory to the company. The plans for the new railroad provide for the building of at least five tubes of 18 ft. 6 ins. in diameter. Three of them will be under the North River and two under the East River. They will rest on pile piers, driven down to solid rock. Each tube will hold a single track. The tunnel system is to converge at the central station in Thirty-Second Street, between Seventh and Ninth Avenues. This station is to be 1500 ft. in length and 500 ft. in width, and will contain twenty-five tracks. The cost of the work is estimated at $50,000,000.

The terms of the franchise provide that in addition to the yearly trackage charges of 50 cents a lineal foot of track, to be doubled after ten years, the company will pay rentals for subsurface stations, for vault privileges, etc., which will bring the total payment to the city for the first twenty-five years to about $2,500,000. The terms are to be readjusted in twenty-five years.

International Congresses at the St. Louis World's Fair

The president of the St. Louis Exposition Company announced last week the organization of a series of world's congresses to be held in St. Louis during 1904. Howard J. Rogers, chief of the department of education, is to be the director of congresses. The advisory board to work in conjunction with him is as follows: Chairman, Nicholas Murray Butler, president of Columbia University, New York city; William R. Harper, president of the University of Chicago; R. H. Jesse, president of the University of Missouri; Henry S. Pritchett, president of the Massachusetts Institute of Technology, and Herbert B. Putnam, librarian of Congress.

The duties of this advisory board will be more exacting than usually fall to the lot of advisory bodies. Upon their recommendations will be determined the number and extent of the congresses, the emphasis to be placed upon special features, the prominent men invited to participate, the character of the programmes and the methods for successfully carrying out the enterprise. No effort will be spared to give the series of congresses at this Exposition unity and connected purpose, and make their published proceedings a valuable contribution to the world's literature.

A series of congresses has been an accompaniment of all recent international congresses, but they have always been disconnected, and rather incident to the Exposition than related to it and supplementary to the exhibits. The work of the director and advisory board will be wholly given to constructing a co-ordinate department of the Exposition which shall have an established scientific value and attract the attention of the practical scholars and experts of the world to St. Louis.

Third Annual Report of the Massachusetts Electric Companies

President Gordon Abbott, of the Massachusetts Electric Companies, in presenting the annual report of the company, said that as the year just finished has been one of the most unfavorable in many years to the operation of street railways in New England, owing to a variety of causes, among which were mentioned a winter of considerable severity, an unusually cold and wet summer, and the coal strikes, the results of the year, which compare favorably with those of previous years, are an evidence, not only of the stability of the business, but also of the devotion and ability of the operating force.

No new consolidations have been effected during the past year, nor have any new properties been acquired, but a large amount of new construction has been done by the companies, shares of which were acquired last year.

The Middleton & Danvers has been extended to Lawrence, and the Haverhill & Andover has built from Haverhill to a junction with the former company, furnishing a new and direct line from both these cities to Salem and Beverly. The Reading, Wakefield & Lynnfield has built several lines with the purpose of connecting an extension built by the Boston & Northern through Tewksbury and Wilmington, with the existing lines of the latter company, and so providing new and direct lines from Lowell, Lawrence, and Haverhill, to Boston. All this work is now finished, and the lines are nearly ready for operation. By this new construction the mileage of the companies has been increased by 41 and now amounts to 860 in twenty-two cities and sixty-six towns. In addition, 25 miles of track have been reconstructed with heavy girder or T-rail, and 55 miles of new feed wire have been strung.

Furthermore, to follow out the policy of improvement outlined in former reports, and to meet the demands of the public for larger and better cars, a large amount of new equipment has been purchased. Two hundred and twenty-eight double-truck closed cars and 100 double-truck open cars have been added, so that, allowing for certain old cars which have been discarded, the increase in seating capacity amounts to 17.69 per cent of the entire equipment as it was a year ago. Five hundred and sixty-six new motors have been added and two new power stations have been built, one at East Woburn and one at Abington. The construction of the plant at East Woburn has resulted in one enabling the closing of two uneconomical existing stations. Besides this, new generators have been installed in Lawrence and Fall River, the total of the new machinery added in all stations amounting to 6900 hp.

To accommodate the increased rolling stock a new car house holding sixty cars has been built in Quincy, and existing car houses in Lawrence, Danvers, Melrose and Fall River have been considerably enlarged.

On the work above enumerated there was expended the sum of $3,083,289, of which $1,671,521 was for construction or betterments of track and buildings, and $1,411,768 for equipment and power.

To meet this expenditure and to provide funds for certain further necessary improvements, permission was obtained in May last for an issue of 55,000 new preferred shares, which have been sold to a syndicate. In accordance with this contract 23,750 of the shares were delivered and paid for prior to Sept. 30. The balance has partly been taken up since that date, and in part will be delivered during the coming winter as funds may be needed by the various companies.

The proceeds of the shares already paid for have been loaned to the sub-companies, it being the desire of the trustees that the floating debt of those companies should be held so far as possible by trustees of the parent company. Thus, since Sept. 30 (for which reason the figures do not appear in the schedules), the companies have been authorized to issue new shares as follows: Boston & Northern Street Railway, 17,973 shares; Old Colony Street Railway, 9487 shares; Lawrence & Reading Street Railway, 1250 shares; while the petitions of the Middleton & Danvers, Haverhill & Andover, and Reading, Wakefield & Lynnfield are still pending.

In the first annual report mention was made of the large number of scattered power stations of the various companies, and of the advantages to be gained by a consolidation into a few large and economical ones. The matter has been carefully studied ever since, but the work has been postponed partly because other improvements seemed more urgent; and partly because it was desirable to take advantage of recent and radical advances in steam engineering.

The time has now arrived when the work can be undertaken, and contracts have been let for 30,000 hp of steam turbines and generators. These will be placed in new stations, and as they will enable the closing of most of the existing ones, we feel confident of very favorable results. The necessary investment will be considerable, but the efficiency of the new machinery as guaranteed by the makers leads the engineers of the companies to calculate that the saving over the present cost of producing power will amount to 8 per cent on the total amount invested in the new power houses, and there will be in addition a large reserve of power for future needs.

The consolidated income account of the operating street railway and electric light companies controlled by the Massachusetts Electric Companies for the year ending Sept. 30, 1902:

Earnings	$6,090,168	$5,778,133
*Expenses	3,827,372	3,915,485
Net earnings	$2,262,796	$1,862,647
Interest, rentals and taxes	1,391,239	937,206
Net divisible income	$871,557	$925,441
Dividends	676,390	779,462
Surplus for the year	$195,167	$145,979

Consolidated surplus account for the year ending Sept. 30, 1902:

Balance Sept. 30, 1901, as per second annual report	$466,286	
Less *Newport & Fall River Street Railway surplus Sept. 30, 1901	5,306	
Balance	$460,980	
Surplus for the year ending Sept. 30, 1902	195,167	
Total		$656,147
Deductions:		
Injuries and damages prior to 1899	$50,083	
Reconstruction	120,000	
Sundry net debits	25,220	
Depreciation fund, Hyde Park Electric Light Company	10,000	
Total deductions		205,303
Balance Sept. 30, 1902		$450,844

†Consolidated balance sheet, Sept. 30, 1902:

ASSETS

Property Sept. 30, 1901	$28,210,600	
Net additions to Sept. 30, 1902	2,941,668	
Property Sept. 30, 1902		$31,152,268
Cash		578,051
Accounts receivable		202,690
Coupon deposits		113,435
Sinking and redemption funds		43,867
Prepaid taxes, insurance and rentals		109,142
Material and supplies		609,453
Total assets		$32,808,906

LIABILITIES

Capital stock	$12,632,200
Funded debt	13,181,500
§Notes payable	4,772,150
Vouchers and accounts payable	752,232
State and local taxes	243,714
Coupons outstanding	113,448
Dividends declared, unpaid	328,133
Accrued interest, rentals and excise tax	321,875
Renewal funds	12,810
Surplus	450,844
Total liabilities	$32,808,906

* In the statement for 1901 taxes were included in expenses. The change has been made this year to conform to the system established by the American Street Railways Accountants' Association.

† Interest sold.

‡ As compared with previous year does not include the Newport & Fall River Street Railway Company, leased to and operated by the Old Colony Street Railway Company, as interest has been sold.

§ Of the amount of $4,772,150, $3,988,650 were held by the Massachusetts Electric Companies and the Massachusetts Street Railway Accident Association.

Massachusetts Electric Companies' statement of profit and loss, year ending Sept. 30, 1902:

INCOME		
Dividends on stocks owned	$697,960	
Miscellaneous interest on notes, etc.	97,993	
Total income		$795,953
EXPENSES		
Salaries—General officers	$9,000	
Printing and stationery	1,897	
Legal expenses	850	
Miscellaneous expenses	5,310	
Total expense		17,148
Net income for the year		$778,805
CHARGES		
Interest on coupon notes		121,500
		$657,305
Dividends (4 per cent on preferred shares)	$602,296	
Dividends accrued on preferred shares, issued July 1, 1902	22,917	625,213
Surplus for the year		$32,093
Surplus Sept. 30, 1901		172,067
Surplus Sept. 30, 1902		$204,160

Massachusetts Electric Companies' general balance sheet, Sept. 30, 1902:

ASSETS	
Sundry stocks, etc., in treasury	$27,850,820
Stocks deposited under indenture of trust Dec. 31, 1900, to secure issue of coupon notes	2,711,000
Cash	25,368
Notes receivable	3,752,900
Accounts receivable	328,771
Discount on sale of preferred shares	166,250
Cash deposited to pay dividends and coupons	3,201
Total assets	$34,838,310
LIABILITIES	
Preferred shares	$17,432,400
Common shares	14,293,100
Coupon notes	2,700,000
Vouchers and accounts payable	750
Accrued dividend on preferred shares	174,324
Accrued interest on coupon notes	30,375
Dividends and coupons uncalled for	3,201
Profit and loss surplus	204,160
Total liabilities	$34,838,310

New Publications

Ancient and Modern Engineering and Isthmian Canals. By William H. Burr, C. E.; 473 pages. Illustrated. Published by John Wiley & Sons. Cloth, $3.50 net.

Under this somewhat general title Professor Burr, of Columbia University, has included some very interesting discussions of important civil engineering works which have been undertaken in ancient and modern times. Part I is devoted to ancient work of this character, and includes descriptions of the pyramids and their methods of construction, the old Roman roads, cement, bridges, aqueducts, etc. Part II., which contains chapters 6 to 12, treats of bridges, their theory of construction, practice and views of characteristic installations of different types. The subject of waterworks for cities and towns is taken up in Part III. Railroad engineering, which is confined to steam railroad engineering, is discussed in Part IV, while Parts V and VI are devoted to the Nicaragua and Panama ship canals respectively. The book is very thoroughly illustrated, and has been written "with the intention of presenting in an agreeable manner to the engineering profession, including advanced engineering students, a body of interesting technical information of the highest practical value." This object has been accomplished by Professor Burr in a very satisfactory manner.

Report of the Twenty-First Annual Meeting of the American Street Railway Association. Published by the Association; 344 pages.

The annual report of the association this year is more replete than usual with interest, and the papers and discussions at Detroit will well repay a second reading. In addition to the report of the proceedings themselves the report contains a list of the attendants at the convention, and a very good steel engraving of President Vreeland. The lists of names of attendants seem to have been very carefully compiled, and the report, as a whole, both typographically and otherwise, reflects great credit on the secretary of the association, who is responsible for its production.

"Notes on the Plotting of Speed-Time Curves," By C. O. Mailloux; 112 pages, with two insets.

Mr. Mailloux's valuable paper, read before the American Institute of Electrical Engineers, June 19, 1902, and published in the STREET RAILWAY JOURNAL, has been reprinted by the author. The paper is by far the most exhaustive treatise which has been published on the subject, and Mr. Mailloux deserves the thanks of all electrical engineers for giving the results of his investigations in this subject with such completeness.

Satisfactory Settlement of Claims in Easton

Street railway companies in large cities which find their claim departments expensive will be interested in an account of the adjustment of the damage claims resulting from an accident on the line of the Easton & Nazareth Street Railway Company, of Easton, Pa., last spring.

On May 22, 1902, which was circus day in Easton, Pa., a large double-truck car, of latest design, left the circus ground on Thirteenth Street with eighty-seven passengers aboard. The road at that time had a number of curves and bad grades, which have since been overcome. The car was going down a steep hill, and for some unknown reason the motorman lost control of it, and on reaching the foot of the hill the car overturned, killing two passengers and injuring sixty. About twenty-seven escaped without any injury, except to their clothing; the clothes of nearly every person on the car were badly damaged.

At the coroner's inquest the company was exonerated from all blame. I. L. Currier, of New York, a friend of the president, and who happened to be in the city, was engaged to settle all of the claims, eighty-seven in number, which he did for less than $1,200. The largest claim paid was $250, which was a death claim. The other death claim was settled for $129.25. Most of the injury claims were settled on a basis of the value of the victim's time lost while in the hospital; for instance, one man who lost two fingers and whose head was badly cut, requiring more than a dozen stitches, was glad to settle his claim for $20, a suit of clothes and a hundred trip pass over the railway. Mr. Currier attributes the satisfactory outcome of his work to several lines of policy followed in the settlement. One of these was that all damage claims should be proved, even if only a suit of clothes was in question. The second was that the company took up these damage claims promptly and not through a lawyer, but by a layman, who visited each injured person, provided medical attendance where necessary and exhibited a sympathetic interest in the case.

The benefits of the prompt settlement of damage from this unfortunate accident are, of course, not confined to the results of this particular accident. It is needless to say that the company will enjoy the benefit of it for a long time to come, not only as a precedent, but also as showing a readiness to meet its just claims promptly, even where they were the unfortunate result of an accident of this kind.

Opening of the Levis County Railway

On Dec. 6 the first section of the new electric railway at the city of Levis, opposite Quebec, was put in operation. The finished line connects the Grand Trunk station, in South Quebec, with the Levis ferry across the St. Lawrence River to Quebec, and two cars will be kept in operation on this section until the completion of the rest of the line. Power is taken from the power station of the Quebec Electric Light Company.

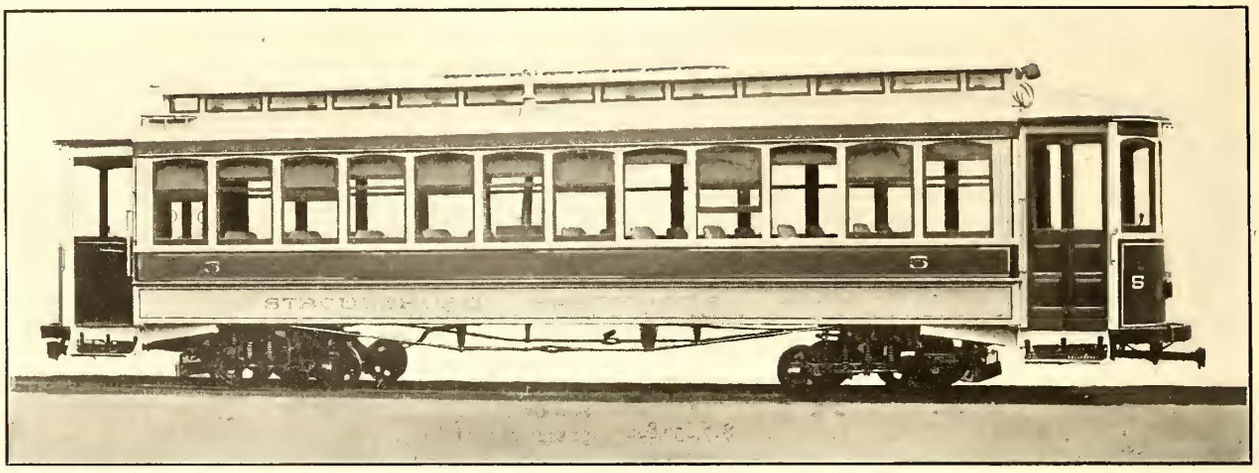
The opening of the line created much enthusiasm in Levis, and the cars were well filled. General Manager Holman received many congratulations on the successful completion of the work, upon which his company has been engaged during the summer.

Grand-Stand Legislation at Oak Park, Ill.

The Village Board, of Oak Park, Ill., a suburb of Chicago, recently repealed the franchises of the street railway lines in Oak Park, owned by the Consolidated Traction Company. To be sure the United States Supreme Court has decided that a franchise given a street railway is in the nature of a contract that cannot be set aside without the consent of both parties thereto, but this made no difference to the Oak Park Board, and it is just as well that they should have their fun repealing franchises, since such action is void under the law.

Semi-Convertible Cars for Stroudsburg

The accompanying photograph shows the style of semi-convertible car recently built for Stroudsburg, Pa., by the J. G. Brill Company, of Philadelphia. The length, 33 ft. 4 ins. over end panels, is somewhat greater than is usual in this type, and affords a seating capacity of forty-eight. The width over the sills is 7 ft. 8½ ins., and over posts at belt 8 ft. This is 2 ins. narrower than customary, but as the roof storage of windows eliminates wall pockets, the interior width is 7 ft. 8 ins. Round-end vestibules are used at either end, and have drop sash and folding doors. The interiors are finished in natural oak with decorated birch ceilings.



SEMI-CONVERTIBLE CAR FOR STROUDSBURG

Brill sand-boxes, angle-iron bumpers, radial draw-bars, ratchet brake-handles and "Dedenda" gongs are furnished. The trucks are "Eureka" maximum traction.

Manila Electric Franchises

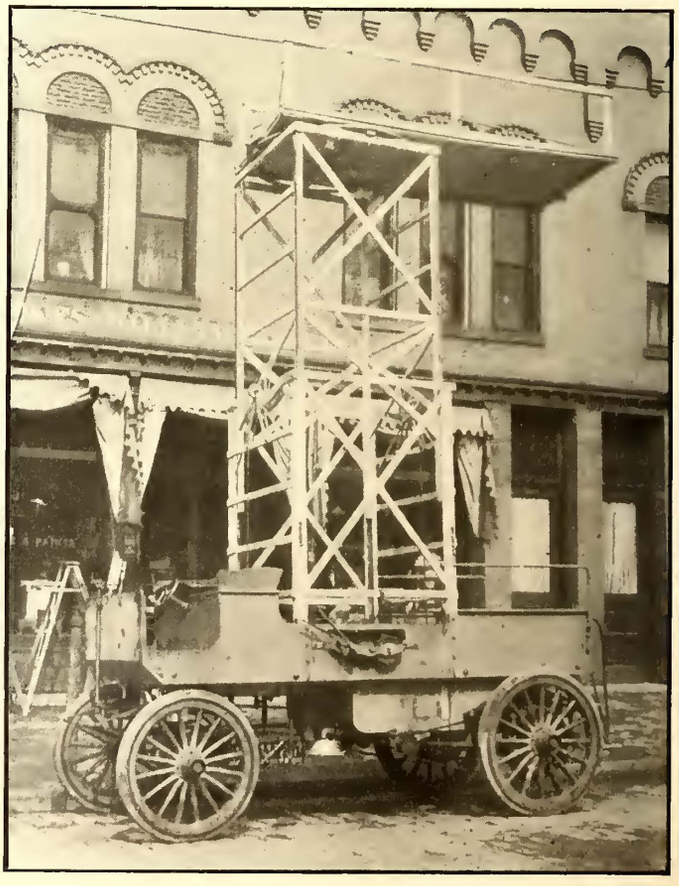
The bureau of insular affairs of the War Department has issued a statement announcing that it is now in a position to furnish intending bidders the full text of the enactment of the Philippine Commission providing for granting franchises for an electric street railway and an electric light, heat and power system in Manila and its suburbs. As previously stated in the Street Railway Journal, the franchises will be awarded after competitive bidding, the bids to be filed in Manila before March 5, 1903, when they will be opened. The route of the proposed system is 35 miles long. The points of competition for bidding are the duration of the franchise, not to exceed fifty years; the rate of fare on the railway not to exceed 7½ cents gold for first-class passengers, and 5 cents gold for second-class passengers, and the compensation to be paid the city of Manila, not less than 1½ per cent of the gross earnings. Construction must begin within six months after awarding the bid, and be completed twenty months thereafter.

Automobile Tower Wagon

The Columbus Railway Company is using an automobile tower wagon in its construction and repair work which contains some features of interest. The accompanying illustration shows the general appearance of the wagon. It will be noticed that the mechanism is carried low to insure stability and firmness when the wagon has a high tower. Power is furnished by a gas engine, similar to those used in stationary service, excepting that the bed-plate is removed and other supports for attaching the machine to the frame are substituted. Special attention was given the design and construction of the running gear. The wheels were especially designed and the axles are of solid steel forging. The frame on which the engine and transmission gear are mounted is forged from angle steel, hot-riveted and reinforced. All bearings are self-aligning and self-lubricating. The speed of the wagon may be regulated by a small hand wheel, and the direction of travel changed by a hand lever. The control is said to be so reliable that no brake is required even in going down a steep hill. An emergency brake is supplied, however.

This wagon has now been in use about two months, and linemen have been using it every day with very satisfactory results, just as they would a horse-drawn wagon. The linemen express themselves as being so well satisfied with it that they would rather work on it than on the old tower wagon.

In making a "hurry" run of say a quarter of a mile the horses will make about the same time as the automobile, but after covering that distance the horses begin to lose time; the longer the run the more they slack up, whereas the automobile wagon will hold the same speed regardless of the distance. There is also a great deal of time saved after having made the run, for in doing the work the wagon will often need to be moved forward 15 ft. or 20 ft., either to let a car pass or to get at a different part of the work, and when they wish to return to the original position the horse-drawn wagon frequently has to be driven out and turned around, whereas the automobile will go forward or backward, as may be required, without turning. When working on a span wire or a feeder-tap connected with two trolleys, the automobile may be run directly across the tracks and it will go forward or back under the cross wire, as may be needed to get in proper location. If a car approaches it needs only to go forward or back a few feet until the car passes, when it immediately returns to its position.



AUTOMOBILE TOWER WAGON

The experience of the Columbus Railway Company has been

that considerable saving is effected in the maintenance of the automobile as compared with the cost of maintaining horses, and an additional advantage is the fact that it is always ready for use however many miles it may have run during the day.

This equipment was built by the Motor Truck & Vehicle Company, of Columbus. It is being placed on the market by J. R. McCardell & Company, of Trenton, N. J.

Chicago Union Traction Appeal Denied

On Dec. 15 the Illinois State Supreme Court handed down its decision in the case of the Union Traction Company's petition asking for a rehearing of the case in which the court had previously decided that universal transfers must be given on all the company's lines. This petition was denied. This ends all litigation on this question as far as Illinois courts are concerned, but the case may be taken by the company to the United States Supreme Court. The decision leaves the situation practically as it stood before the appeal was made.

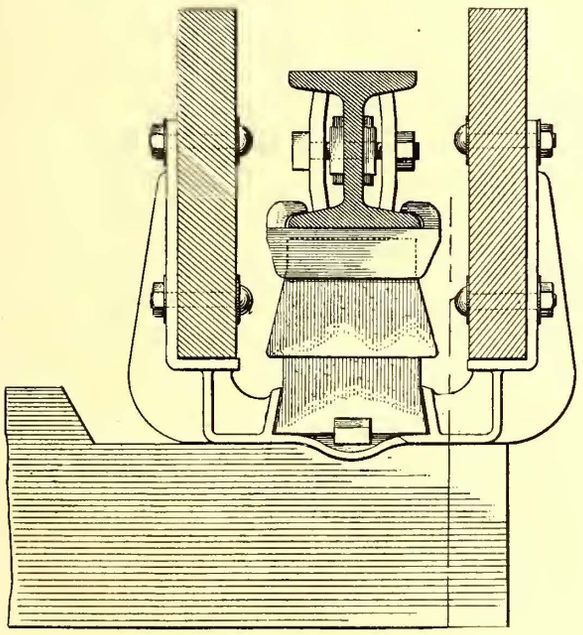
Street Railway Patents

UNITED STATES PATENTS ISSUED DEC. 9, 1902

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

715,286. Street Car Fender; J. Nosek, Prague, Austria-Hungary. App. filed Sept. 3, 1902. The net of the fender is spring-mounted and normally held under the car. When a person is struck, the impact causes the fender to recede, thereby releasing the net, which is pushed forward knocking the feet from under the person and causing him to fall into the net.

715,291. System of Control for Electrically Propelled Vehicles; W. B. Potter, Schenectady, N. Y. App. filed April 8, 1899. Means operated by fluid pressure for actuating the contacts of the controller, step by step, and manually governed electromagnetic means for controlling the application of the fluid pressure.



PATENT NO. 715,329

715,329. Rail Chair and Insulator; W. D. Young, Baltimore, Md. App. filed Oct. 18, 1901. A third-rail chair having a dove-tailed opening for the insulator and side arms for supporting the guard rails.

715,341. Brake Shoe; W. O. Belt, Chicago, Ill. App. filed May 26, 1902. A brake-shoe having an expanded metal strengthening strip at or adjacent to the back face thereof.

715,415. Electric Trolley Wire Hanger; A. Palmros, Columbus, Ohio. App. filed Sept. 24, 1897. The wire is gripped by a pair of shear-clamps supported by a bracket.

715,486. Track-Sanding Apparatus for Electric or Similar Cars; J. S. Lang, Boston, Mass. App. filed April 3, 1902. The motorman by depressing a lever, throws gearing into frictional engagement with the car wheel, thereby rotating fingers in the sand-box to stir up the sand, and at the same time opening the sand valve.

715,712. Brake-Shoe; T. E. Twist, Milton, Pa. App. filed Sept. 16, 1902. The face of the shoe is provided with a hard metal insert consisting of a strip cast in the shoe with separated portions arranged in a general transverse direction and other portions joining their opposite ends in alternation.

715,714. Trolley for Electric Railway Cars; L. E. Walkins, Springfield, Mass. App. filed Jan. 9, 1900. The trolley is connected to the car by a ball and socket joint and trails so that it can raise and lower to compensate for inequalities in the conductor.

ENGINEERING SOCIETIES

NEW YORK RAILROAD CLUB.—"The Operation of the Per Diem System of Settlement for Car Hire" was the subject of a paper prepared by W. B. Casey for the regular meeting of the New York Railroad Club Dec. 19.

NEW ENGLAND RAILROAD CLUB.—At the regular meeting of this society at the Pierce Hall, Boston, on Dec. 9, a paper on "Electrically Driven Shops" was presented by Robert L. Warner, Boston sales manager of the Westinghouse Electric & Manufacturing Company. Mr. Warner's paper was illustrated by a large selection of stereopticon views, showing many examples of the application of direct-current and induction motors to the driving of machine shops, tools and other apparatus.

PERSONAL MENTION

MR. R. S. IVES, who recently resigned as superintendent of the Chicago & Milwaukee Electric Railway Company, of Chicago, was pleasantly surprised a few days ago by the employees of the company, who presented him with a beautiful diamond ring as a token of their appreciation of his labors in their behalf.

MR. CHARLES W. WASON, president of the Cleveland, Painesville & Eastern Railway Company, was presented with a magnificent gold watch last week by the members of the Everett-Moore syndicate and his associates in the Cleveland, Painesville & Eastern Railway Company. The presentation was made at this time because Mr. Wason and his wife will leave Cleveland in a few days on a tour around the world.

MR. WILLIAM MANDELICK, who is secretary of the Yerkes interests in London, is spending a few weeks in this country, and will return to London about the first of next year. Mr. Mandelick was formerly connected with the Sprague Electric Railway & Motor Company, of New York, and afterwards with the Interior Conduit & Insulation Company, and has been connected with the Yerkes interests in London for about two years.

MR. E. GONZENBACH, electrical engineer of the Aurora, Elgin & Chicago Railway Company, left the service of that company on Dec. 1 to give his attention to personal matters. He contemplates a trip to Europe next month. His former duties will be divided, Mr. Howard Brooks, who has been with the company for some time, having charge of third-rail and overhead work. Mr. S. Potter, formerly of the Toronto Railway, will look after the other electrical work.

MR. ALBERT C. BARNEY, a member of the firm of Barney & Smith, of Dayton, Ohio, died at Monte Carlo Dec. 6. Mr. Barney had been suffering for months from heart trouble, and made two trips to Nauheim without improvement. He returned to Paris a few weeks ago, was advised to go to a warmer climate, and started for Monte Carlo. He collapsed at the railroad station, and it was feared by his attendants that he would expire there, but he lingered and failed gradually until he died.

MR. F. E. DRAKE, lately general manager of the Union Elektricitäts Gesellschaft, of Berlin, has just returned to this country. Mr. Drake has been connected with the Union Company for about two years, during which he has had entire charge of the works of the company, and has reorganized them and introduced a number of American improvements in the methods of manufacture. Previous to his connection with the Union Company Mr. Drake was principal assistant to Mr. Peck, special commissioner of the United States to the Paris Exposition of 1900, and while in this capacity rendered very valuable service to all American manufacturers exhibiting at the Paris Exposition, and to American interests in general. Previous to his European experience, Mr. Drake was connected with the Walker Company, and was also for a long time secretary and general manager of the Sperry Electric Company.

FINANCIAL INTELLIGENCE

THE MARKETS

Wall Street, Dec. 17, 1902.

The Money Market

The money market has been through another period of considerable strain during the last week, but at length there seems good ground for believing that the worst has been seen, and that the situation henceforth will begin to grow better. Hope for improvement is based mainly on the indications that currency has commenced to flow back in quantity from the interior. For the seven days ending Saturday, the New York banks had gained upward of $2,000,000 from this source. Although doubt still exists in some people's minds whether this may not be only a temporary response of the inland exchanges to the exceedingly high money premiums at this city, the more general impression is that it is really the first of the regular return movement of crop-moving money, which sets in about this time and continues up to the end of February. Of the other influences making for improvement in money conditions, the most important are the heavy liquidation of the last week on the Stock Exchange, and the visible signs of slackening in the absorption of funds by the Treasury. It is certainly reasonable to expect, if precedent counts for anything, that January will be a much more favorable month than either November or December has been in respect to the Treasury's routine operations in the money market. This is mainly because government expenditures, which grow comparatively light toward the end of the year, are apt to become heavy again in the early part of the new year. The chances are altogether that bank reserves will increase during the next few weeks at least. Money rates, especially for call loans, are likely to be relatively high over the period of the first-of-January disbursements, but already some disposition has appeared toward relaxation in time money rates. Confidence in the situation has been strengthened greatly by the concerted action of a number of leading bankers pledging $50,000,000 in a pool to be loaned out freely in case of need. When this action became known on Monday, it helped greatly to allay apprehension over further trouble in the money market.

The Stock Market

The stock market has passed through a period of liquidation during the past week even more severe than any that have preceded it. Ostensibly the cause of the decline has lain in the unfavorable money conditions as reflected in the excessive loaning rates, especially for time money. But keen observers are inclined to doubt whether the money difficulties of themselves would have been sufficient to occasion such a very severe shakedown, had it not been the plan of the banking interests to force liquidation to its furthest extreme. In other words it would seem that money rates have been kept higher than they naturally would have been for the purpose of encouraging the closing out of speculative accounts. At this writing the worst is believed to have been seen so far as the influence of the money stringency is concerned. In the view of bankers and conservative persons generally, the speculative liquidation has gone as far as is necessary to re-establish a sound position in the financial community. There would be no obstacles in the way of immediate and substantial improvement were it not for the danger which lurks on the political horizon in the crisis that has developed in Venezuela. For the moment this is the subject of greatest concern in the mind of everybody interested in any way in the security market. So far nothing has happened to occasion serious alarm, nor has Wall Street come to really fear that anything serious will happen. But it is the vague possibilities which no one can help feeling under the circumstances that provide a source of constant uneasiness and keep the market in an exceedingly nervous condition. It is an open secret that the $50,000,000 money pool, already alluded to, was formed mainly with the idea that it would serve as a protective fund should the course of political events during the next few days threaten a panic. This knowledge in itself is an additional element of disquiet. Predictions, therefore, regarding the immediate future of the market are extremely unsafe. The only definite conclusion that can be drawn is that were the Venezuela imbroglio to be disposed of, the other forces in the situation would act very quickly to bring about a substantial improvement.

The local traction stocks have done nothing more than follow the course of the general market. They have suffered fully as much as any of the other groups, because the speculation which developed at the time of the Manhattan lease placed them all in a pretty vulnerable position. Brooklyn Rapid Transit has been fairly well protected on the decline by the inside party, which has lately become more aggressive in consequence of the turn for the better in the company's earnings. The 15-point drop in Manhattan from its recent high figures has invited considerable investment buying, and those who are in a position to watch the trading assert that the speculative holdings of the stock have been pretty well cleared out.

Philadelphia

The Philadelphia traction issues, moving in sympathy with the general market, have been extremely weak, touching the lowest prices in a long time past. Philadelphia Rapid Transit broke from 15½ to 14, Union Traction from 47 to 44⅝, Philadelphia Traction from 97¾ to 97, American Railways from 52 to 50, and Fairmount Park Transportation from 25 to 24. Railways General sold at 4, Indianapolis Street Railway at 91 and 92, and Consolidated Traction of New Jersey at 67¼. A partial rally has occurred from these low figures, but the market remains in a very nervous condition. There are no new developments of a local nature in the situation, and, as a matter of fact, no interest attaches to specific conditions in individual properties, while everything depends so manifestly upon the course of the general market. The statement was made in this department of our issue of Dec. 13 that the dividend rate on the American Railways stock was not increased at quarterly meeting. This was an error, as at that meeting the dividend rate was raised from 5 per cent to 6 per cent.

Chicago

Prices have declined as a rule in the Chicago market, but on scattering sales rather than on any important liquidation. City Railway, ex-dividend, fell from 210 to 207, Union Traction went as low as 13¾, Lake Street declined from 9 to 8½, North Chicago Street Railway from 162½ to 160, West Chicago from 84 to 83, Metropolitan Elevated common from 36½ to 35, and the preferred from 85 to 84. General market conditions are, of course, the sole reason for this break. Regarding the Chicago traction situation itself, all the lines, both overhead and surface, are reported to be doing a heavy business; the Metropolitan, for instance, will show, according to present expectations, an increase of 25 per cent in this month's traffic over December a year ago. The action of the Aurora, Elgin and Chicago directors in declaring a 3 per cent dividend on the shares, caused a good deal of unfavorable comment. The company's gross earnings for November were only $16,593, which is far short of the rate necessary to pay the declared dividends. It is a fact, however, that the road has suffered through the delay in obtaining its proper car equipment. It has been operating with only 20 per cent of its intended quota of cars, during the few months since the line was opened. Judging by the results obtained with its facilities thus hampered, officials say that the money paid out in dividends from sources other than earnings will be quickly recovered when the additional cars are obtained.

Other Traction Securities

All the leading Boston stocks have made the lowest prices of the year this week, in sympathy with the movement of the general market. Boston Elevated went as low as 149½ on Saturday, Massachusetts Electric common touched 33, and the preferred 94. Partial recoveries have taken place during the last two days. Apart from Massachusetts common, in which there was a good deal of speculative liquidation, the trading was light. In Baltimore prices have also recorded low levels during the past week. United Railways incomes dropped from 66¾ to 65¾, rallying a trifle later. The general 4s went down from 95 to 94¼, and the stock sold freely at 13. Eleswhere business was at a standstill. A single hundred Nashville Railway stock changed hands at 4½, and small sales were reported of Anacostia and Potomac 5s at 99, North Baltimore Traction 5s at 119¼, City Passenger 4½s at 102¼, and City Passenger 5s at 107. The week's transactions on the New York curb include New Orleans Railways 4½s between 78⅞ and 78, Washington Electric preferred at 47½, Brooklyn City Railroad at 246½, New Orleans common at 13¾, San Francisco subscription rights from 46¼ down to 45, and Interborough Rapid Transit 40 per cent paid at 109 and 107, only 100 shares changing hands at each figure. Miami & Erie Canal was the most active stock on the Cleveland exchange last week, 453 shares changed hands at between 30½ and 31½. Lake Shore Electric common sold for 245 shares at 14 and 14½, the lowest mark in some time. A small lot of Elgin, Aurora & Southern sold at 50, Northern Ohio Traction preferred receipts went at 95¼, and Western Ohio receipts dropped to 26 for a small lot. Springfield & Xenia sold at 16¾, a very low figure.

Security Quotations

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

	Closing Bid	
	Dec. 9	Dec. 16
American Railways Company	52	51¾
Aurora, Elgin & Chicago	a39	39
Boston Elevated	153	150
Brooklyn R. T.	64½	65⅝
Chicago City	210	208
Chicago Union Tr. (common)	14	13
Chicago Union Tr. (preferred)	45	45
Cleveland Electric	85	86¼
Columbus (common)	58	60
Columbus (preferred)	105	105½
Consolidated Traction of N. J.	68¾	68
Consolidated Traction of N. J. 5s	107¼	107¾
Detroit United	—	86½
Electric People's Traction (Philadelphia) 4s	98	98¼
Elgin, Aurora & Southern	45	53
Indianapolis Street Railway 4s	—	86¾
Lake Shore Electric	12½	13¾
Lake Street Elevated	9¼	8¾
Manhattan Railway	147¾	143¼
Massachusetts Elec. Cos. (common)	35¾	34
Massachusetts Elec. Cos. (preferred)	94	—
Metropolitan Elevated, Chicago (common)	36	35⅝
Metropolitan Elevated, Chicago (preferred)	83	85
Metropolitan Street	139¾	136¾
New Orleans Railways (common)	13⅞	13½
New Orleans Railways (preferred)	45⅛	44½
North American	115	111¾
Northern Ohio Traction (common)	—	—
Northern Ohio Traction (preferred)	95	—
North Jersey	30	30¾
Northwestern Elevated, Chicago (common)	30	—
Philadelphia Rapid Transit	15¾	15
Philadelphia Traction	97¼	97
St. Louis Transit (common)	27	27½
South Side Elevated (Chicago)	107	109
Syracuse Rapid Transit	30¾	32
Syracuse Rapid Transit (preferred)	75	79
Third Avenue	—	125
Toledo Railway & Light	a35	35
Twin City, Minneapolis (common)	115½	114
United Railways, St. Louis (preferred)	81	82
United Railways, St. Louis, 4s	84⅝	84½
Union Traction (Philadelphia)	47	45¼
Western Ohio Receipts	27¼	26

a Asked. b Last sale.

Iron and Steel

The output of pig iron, according to the monthly figures of the Iron Age, is again increasing rapidly, and if it were not for the difficulty in obtaining fuel, it would, in the opinion of the same authority, surpass all records. Production is now reckoned at 336,617 tons weekly, an increase of 6500 tons weekly over the outturn of last month. Inability to supply themselves at home has led some of the steel manufacturers to import Bessemer pig from abroad, which, it seems, can be done about as cheaply even with the duty paid as to buy at home. Other features of the iron situation are the heavy trade in sheet steel, in plates and in structural material, and the enormous orders ahead for steel rails. It is said that the rail mills already have on their books orders for 1,800,000 tons of rails for next year's delivery, not counting the surplus of unfinished orders which will be carried over from this year. Quotations are as follows: Bessemer pig iron, $21.75 a $22; Bessemer steel, Pittsburgh delivery, $29; steel rails, $28.

Metals

Following are the quotations for the leading metals: Copper, 11¾ cents, tin 25¼ cents, lead 4⅛ cents, and spelter 4.90 cents.

SAN FRANCISCO, CAL.—The United Railway & Investment Company, of San Francisco, has declared a dividend of 1½ per cent on the preferred stock, payable Jan. 3 to stock of record of Dec. 20.

FORT WAYNE, IND.—The Fort Wayne Traction Company, embracing all the city transportation lines, the line between the feeder canal and St. Joe River, as well as the Robinson Park summer resort, passed into new hands Dec. 10. The purchasers include Henry C. Paul and Senator S. B. Fleming, of Fort Wayne; James Murdock, Samuel Murdock, Charles Murdock, of Lafayette; George McCullough, who is interested in the Union Traction Company, of Anderson; Colonel J. Levering Jones, of Philadelphia, who represents a syndicate of Eastern bankers.

FRANKFORT, KY.—It is announced that Colonel John J. Webb, of Springfield, Ohio, has just completed the purchase of the Frankfort & Suburban Railway Company, operating 7 miles of track. Colonel Webb is interested in several important interurban railways in Ohio.

FRAMINGHAM, MASS.—The Framingham Union Street Railway Company and the Framingham, Southboro & Marlboro Street Railway Company have each declared an annual dividend of 5 per cent, payable Jan. 1, 1903.

HAVERHILL, MASS.—The Haverhill & Southern New Hampshire Street Railway Company has asked the Railroad Commissioners for permission to increase its capital stock from $60,000 to $80,000.

LOWELL, MASS.—The Lowell & Pelham Street Railway Company has asked the Railroad Commissioners for authority to increase its capital stock from $10,000 to $40,000.

LAWRENCE, MASS.— The Lawrence & Methuen Street Railway Company has asked the Railroad Commissioners for authority to increase its stock from $70,000 to $125,000.

STOUGHTON, MASS.—Judge Colt, in the United States Circuit Court, has denied the petition of William A. Clarke to complete the sale of the Stoughton & Randolph Street Railway by permitting him to pay the balance due ($45,000) on the recent sale. The court will probably order another sale of the property.

DETROIT, MICH.—The earnings of the Detroit United Railway for November were $312,365, a gain of $37,196 over the same month last year.

DETROIT, MICH.—The directors of the Detroit United Railway met in this city last week. The usual quarterly dividend of 1 per cent was declared, and it was voted to spend the extra 3 per cent in improvements, chiefly in improved rolling stock and extensions. It is stated the company is now earning 7 per cent on its capital stock. The Sandwich, Windsor & Amherstburg Railway Company, the majority of whose stock is controlled by the Detroit United, will issue a twenty-year 4½ per cent mortgage for $600,000 to provide for the extension of the road to Amherstburg.

ST. LOUIS, MO.—The statement of the St. Louis Transit Company shows the total earnings for November to be $553,577, as against $479,390 in November, 1901, or a total gain of $74,187. The total earnings for the first eleven months of the present year amount to $5,898,276. For the same period last year the earnings were $5,307,597. These figures show a total gain of $591,194 for this year over 1901. An official of the company says that the net earnings will show a gain proportionate to the gross earnings. The percentage of operating expenses and taxes to the gross earnings has been scaled down to a low figure.

MANCHESTER, N. H.—The Manchester Traction, Light & Power Company has declared a regular semi-annual dividend of 3 per cent, payable Jan. 15, to stock of record Jan. 6.

NEW YORK, N. Y.—The following has been sent out from the office of August Belmont & Co.: The remaining six instalments of 10 per cent each on part-paid stock of the Interborough Rapid Transit Company are hereby called, payable at our office on following dates: Jan. 5, Feb. 2, March 2, April 1, May 1 and June 1. Certificates must be presented for endorsement at time of the respective payments.

TOLEDO, OHIO.—The Maumee Valley Railway & Light Company was organized Dec. 12, with a captital stock of $1,000,000, for the purpose of taking over the Toledo & Maumee Valley Railway and the Toledo, Waterville & Southern Railway.

AKRON, OHIO.—The Northern Ohio Traction Company's railway department earned $52,310 during November, a gain of $13,304 over the same month last year.

SPRINGFIELD, OHIO.—It is announced that ex-Governor Asa A. Bushnell, who, it is said, realized something like $5,000,000 from the sale of his interests in the Warder, Bushnell & Glessner Company, has formed an alliance with Colonel John G. Webb, of Springfield, a prominent electric railway promoter, for the purpose of establishing the largest interurban system in the Central West.

CLEVELAND, OHIO.—The earnings of the Elgin, Aurora & Southern Traction Company for November were $28,607, a gain of $6,068 over the same month last year.

CLEVELAND, OHIO.—Gross earnings of the Aurora, Elgin & Chicago Railway for the month of November were $16,594.

CLEVELAND, OHIO.—The gross earnings of the Cincinnati, Dayton & Toledo Traction Company for November were $38,315, a gain of $6,759 over November, 1901.

COLUMBUS, OHIO.—The Columbus, Buckeye Lake & Newark Traction Company has declared its first dividend on the $500,000 preferred stock, 1½ per cent payable Jan. 1, to stock of record Dec. 20.

CANTON, OHIO.—The Canton-Akron Company has declared a semi-annual dividend of 3 per cent, payable Jan. 1 to stock of record Dec. 20.

ALLENTOWN, PA.—The Allentown & Reading Traction Company has filed a mortgage to secure $750,000 bonds.

GREENSBURG, PA.—A mortgage for $1,100,000 has been placed on record in Westmoreland County by the Pittsburgh & Allegheny Railway Company, which is building from Appollo to Leechburg by way of Vandergrift, with an extension to New Kensington. The mortgage is given in favor of the Public Trust Company, of Pittsburgh.

PHILADELPHIA, PA.—The Interstate Railways Company, mention of whose incorporation was made in the STREET RAILWAY JOURNAL for Dec. 13, has established an office at Reading, Pa., with W. W. Light as treasurer, and a call has been issued for 25 per cent of the subscriptions. Although no authoritative information concerning the plans of the company is available, it is still declared that the purpose of the company is to put through the reported merger of New Jersey, Pennsylvania and Connecticut properties. In fact, there seems to be a growing tendency to magnify the purposes of the company, and recently the United Power & Transportation Company has been mentioned as a party to the operations of the company. That complete secrecy can be much longer maintained concerning the company is improbable.

PHILADELPHIA, PA.—The American Railways Company reports for November gross earnings of $94,599, an increase of $20,784; from July 1 an increase of $124,717 is shown.

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. *a* Comparison is made with 1900 because in 1901 the earnings were abnormal on account of the Pan-American Exposition.

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., Oct. '02	65,627	36,333	29,294	12,603	16,692
	1 " " '01	51,479	28,769	22,710	12,438	10,272
	6 " June '02	318,937	185,362	133,575	77,556	56,018
	6 " " '01	268,967	164,458	104,510	63,494	41,016
	12 " Dec. '01	617,011	* 350,845	266,166	136,162	130,004
	12 " " '00	513,725	* 317,475	196,249	141,133	55,117
ALBANY, N. Y.						
United Traction Co.	1 m., Sept. '02	132,606	81,990	50,616	23,866	26,750
	3 " " '02	414,635	251,739	162,897	71,598	91,299
BINGHAMTON, N. Y.						
Binghamton St. Ry. Co.	1 m., Oct. '02	17,107	10,693	6,414	------	------
	1 " " '01	16,884	9,293	7,591	------	------
	4 " " '02	82,360	44,675	37,685	------	------
	4 " " '01	80,044	40,317	39,727	------	------
BOSTON, MASS.						
Boston Elev. Ry. Co.	12 m., Sept. '02	11,321,030	7,862,571	3,458,458	2,836,560	621,898
	12 " " '01	10,869,496	7,336,597	3,532,899	2,896,359	636,539
Massachusetts Elec. Cos	12 m., Sept. '02	6,090,168	3,827,372	2,262,796	1,391,239	871,557
	12 " " '01	5,778,133	3,915,486	1,862,648	937,206	925,442
BROOKLYN, N. Y.						
Brooklyn R. T. Co.	1 m., Oct. '02	1,114,772	644,975	469,796	------	------
	1 " " '01	1,067,131	703,612	363,519	------	------
	4 " " '02	4,702,511	2,526,749	2,175,761	------	------
	4 " " '01	4,478,232	2,735,857	1,742,374	------	------
	12 " June '02	12,789,705	*8952214	3,837,490	------	------
	12 " " '01	12,101,198	*7970635	4,130,563	------	------
BUFFALO, N. Y.						
International Tr. Co.	1 m., *a* Sept. '02	321,355	161,525	159,831	77,502	82,329
	1 " " '00	255,322	108,934	146,388	81,931	64,457
	3 " " '02	1,019,518	506,664	512,854	235,741	277,113
	3 " " '00	791,470	344,745	446,725	245,793	250,932
CHARLESTON, S. C.						
Charleston Consol'ted Ry. Gas & El. Co.	1 m., Oct. '02	40,739	27,246	13,494	13,469	25
	1 " " '01	39,038	24 562	14,476	13,842	634
	8 " " '02	439,007	256,962	182,045	108,062	73,984
	8 " " '01	324,120	211,870	112,250	110,049	2,201
CHICAGO, ILL.						
Chicago & Milwaukee Elec. Ry. Co.	1 m., Nov. '02	14,112	6,389	7,723	------	------
	1 " " '01	12,047	5,804	6,237	------	------
	11 " " '02	177,251	72,784	104,467	------	------
	11 " " '01	159,453	68,234	91,218	------	------
CLEVELAND, O.						
Eastern Ohio Traction Co.	1 m., Oct. '02	17,365	10,142	7,224	6,033	1,190
	10 " " '02	161,071	89,603	71,468	54,574	16,894
Cleveland, Elyria & Western	1 m., Nov. '02	27,924	16,745	11,180	------	------
	1 " " '01	21,125	12,370	8,756	------	------
	11 " " '02	276,135	154,826	121,309	------	------
	11 " " '01	229,853	125,768	104,085	------	------
	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., Oct. '02	16,213	9,655	6,558	------	------
	1 " " '01	15,639	8,558	7,081	------	------
	10 " " '02	160,677	86,620	74,057	------	------
	10 " " '01	139,824	71,801	68,022	------	------
	12 " Dec. '01	164,971	* 87,102	77,869	72,500	5,369
COVINGTON, KY.	12 " " '00	141,112	* 89,592	71,520	72,500	† 980
Cincinnati, Newport & Covington Ry. Co.				42,823	22,238	20,585
	1 m., Aug. '02	96,118	* 53,295	28,784	15,807	12,977
	1 " " '01	74,525	* 45,741	252,130	131,230	120,899
	8 " " '02	596,156	* 344,026	208,169	125,328	82,841
	8 " " '01	535,784	* 327,615			
DETROIT, MICH.						
Detroit United Ry.	1 m., Nov. '02	290,750	* 167,494	123,256	------	------
	1 " " '01	254,807	* 148,682	106,125	------	------
	11 " " '02	3,171,835	*1791318	1,380,517	------	------
	11 " " '01	2,767,730	*1531048	1,236,682	------	------
Detroit and Port Huron Shore Line (Rapid Ry. System)	1 m., Oct. '02	34,869	21,269	13,600	------	------
	1 " " '01	31,008	18,747	12,261	------	------
	4 " " '02	172 527	96,176	76,351	------	------
	4 " " '01	156,956	81,903	75,053	------	------
DULUTH, MINN.						
Duluth-Superior Tr.	1 m., Oct. '02	46,587	26,254	20,333	9,590	10,742
	1 " " '01	38,678	22,523	16,156	9,181	6,975
	10 " " '02	442,845	233,248	209,597	96,410	113,188
	10 " " '01	373,946	204,074	169 872	91,559	78,313
ELGIN, ILL.						
Elgin, Aurora & Southern Tr.	1 m., Oct. '02	33,648	21,041	12.607	8,333	4,274
	1 " " '01	28,578	16,964	11,614	8,333	3 280
	10 " " '02	341,890	200,165	141,725	83,333	58,391
	10 " " '01	304,144	170,289	133,855	83,333	0,522
FINDLAY, O.						
Toledo, Bowl'g Green & Southern Traction Co	1 m., Sept. '02	24,289	13,173	11,116	1,991	9,126
	1 " " '01	15,833	11,067	4,766	635	4,130
	7 " June '02	142,108	76 228	65,880	28,989	36,890
	7 " " '01	105,329	67,679	37,649	20,752	16,898
HAMILTON, O.						
The Cincinnati, Dayton & Toledo Trac. Co.	1 m., Oct. '02	41,747	22,648	19.099	16,512	2,587
	5 " " '02	226,249	113,854	112,395	81,753	30,642
LONDON, ONT.						
London St. Ry Co.	1 m. Nov. '02	12,356	7,208	5.148	1 850	3,298
	1 " " '01	12,084	6,002	6,082	2,176	3,907
	11 " " '02	139,662	85,428	54,234	24,044	30,189
	11 " " '01	128,898	78,276	50,622	21,976	28,646
MILWAUKEE, WIS.						
Milwaukee El. Ry. & Lt. Co.	1 m., Nov. '02	239,015	105,878	133,137	67,663	65,474
	1 " " '01	206,356	102,286	104,069	63,166	40.903
	11 " " '02	2,493 809	1,167,289	1,326,521	732,288	594,232
	11 " " '01	2,198,416	1,079,875	1,118,541	687,977	430,564
	12 " Dec., '01	2,442,342	1,185,534	1,256,808	755,139	501,669
	12 " " '00	2,226,698	1,129,787	1,090,911	824,665	266,247
MINNEAPOLIS, MINN.						
Twin City R. T. Co.	1 m., Oct. '02	304,317	140,226	164,091	60,233	103,857
	1 " " '01	270,952	118,054	152,898	58,163	94,734
	10 " " '02	2,971,411	1,331,546	1,639 866	590,967	1,048,899
	10 " " '01	2,611,118	1,186,902	1,424,216	561,437	862,778
MONTREAL, CAN.						
Montreal St. Ry. Co.	1 m., Oct. '02	181,403	96,418	84,986	15,992	68,995
	1 " " '01	166,061	85,210	80,850	15,384	65,466
	12m., Sept. '02	2,046,209	1,135,176	911,032	------	------
	12 " " '01	1,900,680	1,105,267	795,413	------	------
NEW YORK CITY.						
Manhattan Ry. Co.	12 m., Sept. '02	11,583,546	5,545,395	6,038,151	2,712,089	3,326,062
	12 " " '01	10,455,872	5,328,649	5,127,223	2,683,132	2,444,091
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 '02	15,866,641	7,385,888	8,480,758	4,815,421	3,665,337
	12 " " '01	14.720,767	6,755,131	7,965,636	4,534,068	3,431,567
OLEAN, N. Y.						
Olean St. Ry. Co.	3 m., Sept. '02	18,401	8,135	10,266	4,062	6,203
	3 " " '01	16,372	6,887	9,485	4,200	5,285
	12 m., June '02	56,055	29,118	26,937	16,318	10,619
	12 " " '01	52,018	26,228	25,790	16,755	9,035
PEEKSKILL, N. Y.						
Peekskill Lighting & R. R. Co	1 m., Oct. '02	9,023	5,706	3,317	2,083	1,234
	4 " " '02	37,696	21,586	16,110	8,333	7,777
	12 " June '02	86,795	*56,392	30,402	23.125	7.277
PHILADELPHIA, PA.						
Union Traction Co.	12 m., June '02	14,118.159	6,403,338	7,715,820	*6637781	1,078,038
	12 " " '01	13,431,681	5,836,186	7,595,494	*6734328	861,266
American Railways.	1 m., Nov. '02	94,600	------	------	------	------
	1 " " '01	73,815	------	------	------	------
	5 " " '02	544,059	------	------	------	------
	5 " " '01	418.947	------	------	------	------
	12 " June '02	1,009,509	------	------	------	------
	12 " " '01	844,298	------	------	------	------
ROCHESTER, N. Y.						
Rochester Ry.	1 m., Sept. '02	93,762	46,063	47,699	24,833	22,866
	1 " " '01	82,428	45,854	36,573	24 942	11,632
	9 " " '02	821,852	433,691	388,161	223,361	164,800
	9 " " '01	758,110	449,253	308,858	222,018	86,840
SYRACUSE, N. Y.						
Syracuse R. T. Co.	1 m., Nov. '02	59,586	32,644	26,942	19,025	7,917
	1 " " '01	56,206	30,825	25,381	19,025	6,356
	4 " " '02	243,9 0	133,868	110,032	76,100	33 932
	4 " " '01	224,574	122,351	102,223	76,046	26,177
TOLEDO, O.						
Toledo Ry. & Lt. Co.	1 m., Oct. '02	124,488	60,484	64,004	38,833	25,171
	1 " " '01	114,666	54.617	60,050	37,813	22,237
	10 " " '02	1,193,546	607,072	586,474	381,541	204,933
	10 " " '01	1,013,766	515,502	558,264	339,543	218,721
	12 " Dec. '01	1,311,084	* 636,407	674,677	415,168	259,509
	12 " " '00	1,182,517	* 616,945	565,572	409,051	156,521
Lake Shore Elec. Ry. Co.	1 m., July '02	49,122	25,961	23,161	------	------
	1 " " '01	39,447	21,837	17,610	------	------
NEW BRIGHTON, S. I.	7 " " '02	237 855	158,911	78,944	------	------
	7 " " '01	187,270	133,283	53,987	------	------
Richmond Light & R. R. Co., formerly Staten Island Elec. Ry.	3 m., Sept. '02	73.687	43,950	29,737	18,930	10,807
	3 " " '01	80,197	42,103	38,094	27,221	10,873
YOUNGSTOWN, O.						
Youngstown - Sharon Ry. & Lt. Co.	1 m., Oct. '02	41,434	*23,900	17,534	------	------
	4 " " '02	155,956	*86 940	69,016	------	------
	6 " June '02	198,050	* 110,391	87,659	------	------