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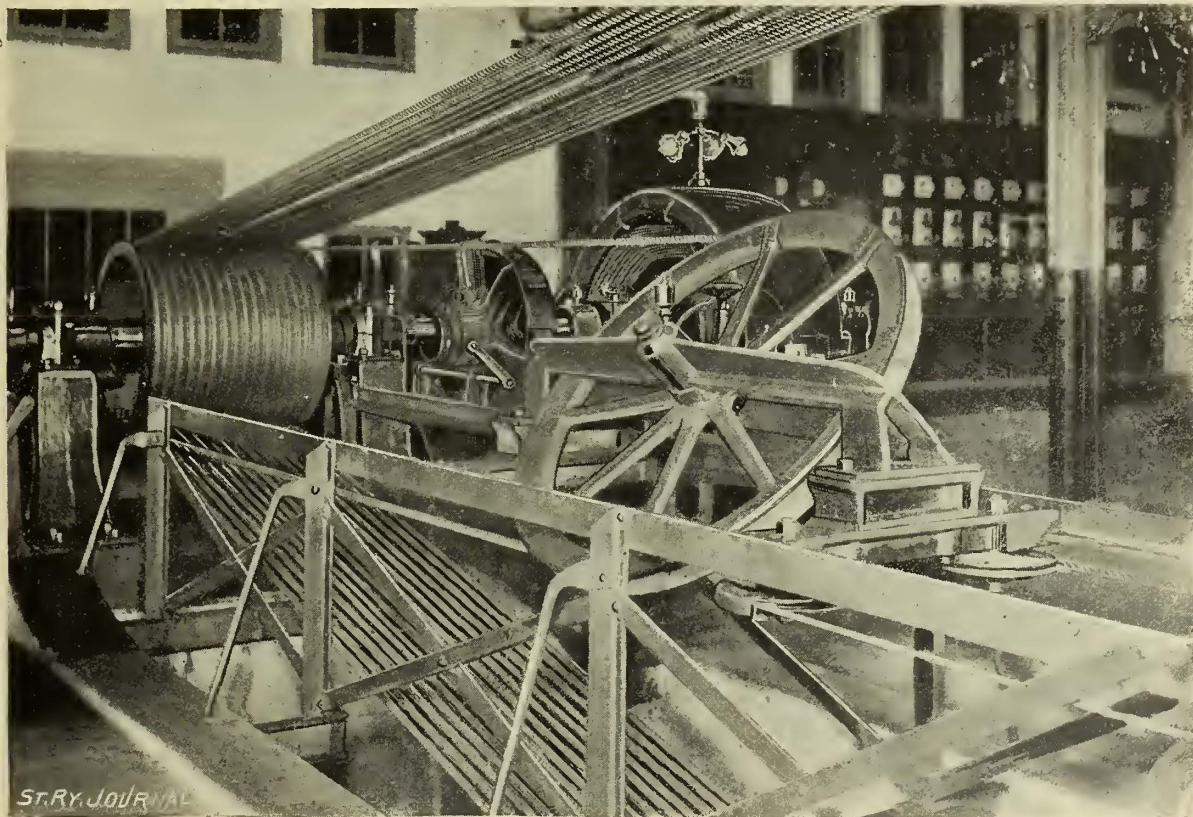
No. 1.

Tension Apparatus for Cotton Rope Drives.

The accompanying illustration is an enlarged view of the tension apparatus employed in the power plant of the Los Angeles Consolidated Railway Co., and which was briefly mentioned in the description of the plant given in the December issue of the STREET RAILWAY JOURNAL. The illustration shows a direct belting of a 500 H. P. Westinghouse multipolar generator, and it will be noted that the power is transmitted by an endless

McMahon Ammonia Motor at the World's Fair Grounds.

At Jackson Park, Chicago, a railway system of fourteen miles has already been constructed. The system affords excellent facilities for testing severely new motors which inventors desire to operate on the grounds when the Exposition is opened. As the authorities of the Fair are constantly at the grounds they have abundant opportunities to inspect the apparatus. The illustration on next



ROPE DRIVE TENSION SHEAVE.—LOS ANGELES CONSOLIDATED ELECTRIC RAILWAY.

cotton rope, one loop of which is led around a tension carriage mounted in position as shown. The ropes for supporting the tail weight of the carriage are attached to horizontal sheaves shown under the base of the frame. While this is not a novel scheme in rope drives, it is the only one, so far as we know, employed in an electric railway plant, and its success in this field will be watched with interest.

THE use of electric cars on trunk lines may soon become an assured fact. The Edison General Electric Co. have submitted estimates to the Illinois Central Railroad Co. for the necessary apparatus for such a service, and the installation, if made, will probably be first for a suburban traffic at Chicago. A number of the Chicago directors of the Illinois Central Co. are said to be enthusiastic over the proposition.

page shows the new ammonia street car motor which is now being tested at the grounds. The photograph was taken when the car was in front of the Woman's Building, the construction of which has advanced more rapidly than any structure in the enclosure. The inventor of the system is P. J. McMahon, and it is exploited by the Standard Fireless Engine Co., of Chicago.

The motor is operated by anhydrous ammonia, and it consists of a double engine of the same form and appearance as those used in small locomotives. The anhydrous ammonia as a liquid is carried in a drum contained in an iron tank under a pressure ranging from 150 to 185 lbs. This drum connects with a similar drum which serves the same purpose as the dry pipe of a steam engine; that is, to give dry gas. In a part of the iron tank separated from the ammonia is a certain amount of water into which the exhaust is discharged and absorbed. As the

affinity between water and ammonia is great, the absorption is produced with great rapidity, and no back pressure, or practically none, takes place. The cylinders of the engine are enclosed in a tank so that the gas escaping from leaks is at once absorbed. This arrangement also prevents freezing of the cylinders. From the escape or expansion of the gas, the absorption of heat is so great as to produce an extreme lowering of temperature, but as the water absorbs the ammonia, heat is produced in the solution which serves to equalize the temperature and prevent freezing. In fact, the heat produced is greater than could be utilized, and for this reason the exhaust gas and the solution pass through a number of small tubes which serve to return the surplus heat to the anhydrous solution.

When the gas has been used to such an extent that the pressure is insufficient to operate the motor the car is run into the generating station, the spent liquor is withdrawn, and the gas tank is filled again. The spent liquor is then pumped from the receiving tank to the generator where the application of heat serves to separate the gas from the water, the gas passing into a separator where it is freed from the small amount of water carried over as steam and then passes on to the condenser which consists of a number of pipes where a constant stream of water flowing over the pipes cools and condenses the gas to a liquid which then passes into the supply tank. The heat in the generator serves to expel the greater portion of the gas so that nearly pure water is left and this is withdrawn from the generator and stored in a tank until used to supply the absorption tank on the motor. The charging and discharging is accomplished in about two minutes.

It is asserted that the cost of operating the motor is quite small and improvements are being made which will make the machine still more economical.

Meeting of the National Electric Light Association.

The fifteenth convention of the National Electric Light Association will be held at the Iroquois Hotel Buffalo, N. Y., February 23, 24 and 25, 1892. Mr. C. O. Baker, Jr., has been appointed general master of transportation, with headquarters at 136 Liberty Street, New York.

The proceedings of the Association, owing to the intimate relations growing between the electric light and street railway interests, are of more importance to street railway managers each year. At the last convention of the Association, which was held in Montreal during the past summer, a large number of gentlemen prominent in street railway lines were present, and undoubtedly many will take the occasion to go to Buffalo next month to attend the sessions of the Association there.

Chicago Street Railway Commission.

The commission appointed by Mayor Washburne of Chicago to consider the matter of improving the street railway facilities of the city, has already held several meetings. Alderman Sexton, the chairman, in calling the committee to order for the first time, stated the problem in these terms:

"Chicago is growing at the rate of 1,000 a week. The World's Fair will soon be here. If we can't handle the people now, what are we going to do in a few years or when the Exposition opens? Our deliberations require haste. Whatever we do, let us do it at once. Let us have continued and earnest work. I believe our action will be accepted by the Council and sanctioned by the people."

It was voted to divide the work into four sections and to appoint committees as follows:

Cause — Biegler, Ream, Stauber.

Immediate Relief — Stone, Kerr, Yerkes.

Permanent Relief — Hesing, Cullerton, Purington, Wheeler.

Steam and Elevated Roads — Martin, Gorton, Corbin.

At the second meeting of the commission Alderman Goldzier presented a suggestion for relieving the North Side road. His idea is to make the downtown loop underground. Mr. Goldzier's remarks explain his plans:

"The main cause of the trouble is the congestion in the centre of the city. Suppose the La Salle Street tunnel be continued for a loop with no other opening afforded on the side except one on La Salle Street just north of Randolph Street. Have an open space at this point 200 ft. long

and almost the width of the street for unloading and loading passengers. The open space would afford an opportunity for preventing the overcrowding of cars, and all persons wanting to go to the North Side could take the cars at this point. I think the loop should be much shorter than the present one. There would be no delay, and it would not be necessary to have so large a loop. This would greatly relieve the congested condition of the street and would take away the cumbersome cable trains. Horse cars could be operated to connect with the cable at La Salle and Randolph Streets. Under the present conditions suppose Mr. Yerkes would put on twice as many cars, the streets would be more blocked and the transportation would be worse than it is now. If my scheme is feasible there is no limit to the number of cars except the strength of the cable."

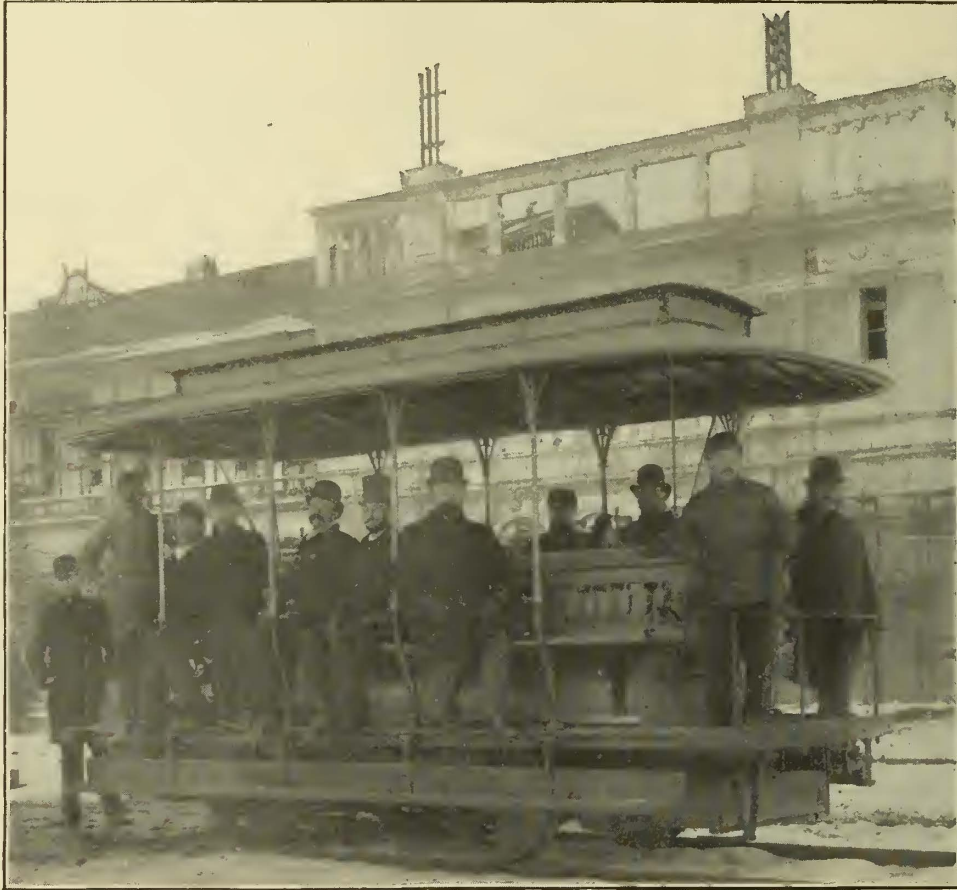
This suggestion of Mr. Goldzier, while novel and interesting, has been seriously criticised and been declared entirely impracticable. It would be unsafe, on account of the great crowds, to attempt to load all passengers at one point. The city engineer, however, has stated that there are no unsurmountable engineering difficulties.

At this session J. M. Hannahs described his well known elevated system.

At the third meeting of the commission it was decided to send the following list of questions to the cable companies with the request that they answer the queries as soon as possible:

To the South Side company:

1. How much time it consumed in making the circuit of the loop



McMAHON'S AMMONIA MOTOR CAR.

2. How many cars can be accommodated on the loop?
 3. What is the average number of passengers carried by each car during "rush" hours?
 4. What is the maximum number of cars on Wabash Avenue during rush hours?
 5. Ditto on State Street?
 6. What is the running time from the southern terminus of the cable on State Street to the corner of State and Madison Streets?
 7. Ditto on Cottage Grove Avenue?
- To the North Side company:
1. First three questions same as for South Side.
 4. Maximum number of cars on Clark Street during the rush hours?
 5. Ditto Lincoln Avenue?
 6. Ditto Clybourne Avenue?
 7. Ditto Sedgwick Street?
 8. Ditto Larrabee Street?
 9. Running time from northern terminus on Clark Street to Illinois Street and La Salle Avenue?
- To the West Side company:
1. First three questions same as above.
 4. Maximum number of cars on Madison Street during rush hours?
 5. Same on Milwaukee Avenue?
 6. Running time from western terminus on Madison Street to corner Washington Street and Fifth Avenue?
 7. Ditto on Armitage Avenue?

Alexander Clark presented to the commission the claims of the Chicago & Evanston Electric Railway, a brief description of whose system is given elsewhere in this issue. Coming to the question of motive power he said:

"The motive power will be electricity. Motors weighing 30,000 lbs. will be used, having a capacity to haul 200 tons on the level. These

system, in his opinion. He suggested first that the South Side Rapid Transit Co. be compelled to build at once its line from Van Buren Street to Jackson Park. This road he thought, should connect with an underground electric road at Fourteenth Street, which would extend north under State Street, below sewers and under the river to the Southwest corner of Lincoln Park. He thought the

tunnel should be built a double iron tubular construction. He proposed an elevated track from the point extending over the sidewalk along the west line of the park to North Park Avenue to near Fullerton Avenue,

and then in a direct line to Diversey Street and Clark Street to connect with the horse cars. Stations were provided at intervals for the underground portion.

An elevated road operated by electricity on Wabash Avenue was suggested.

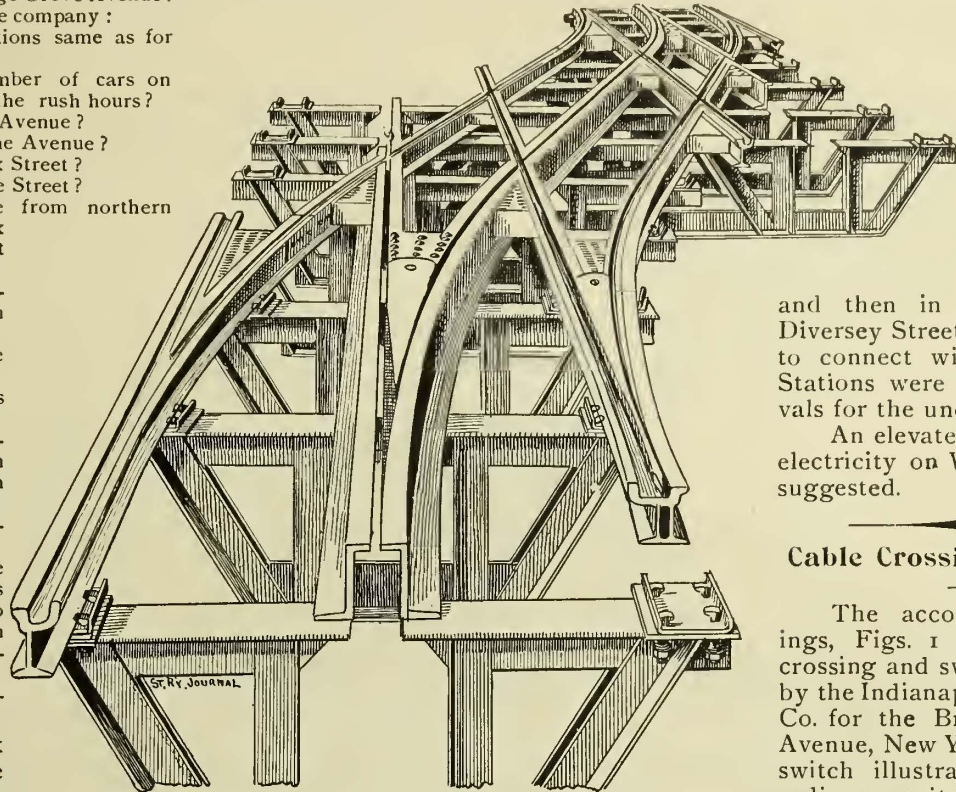


FIG. 1.—SWITCH CONSTRUCTION—BROADWAY (N. Y.) CABLE LINE.

Cable Crossing and Switch.

The accompanying engravings, Figs. 1 and 2, illustrate a crossing and switch recently made by the Indianapolis Frog & Switch Co. for the Broadway & Seventh Avenue, New York, cable line. The switch illustrated in Fig. 1 is the ordinary switch construction, of which there are quite a number

placed at suitable intervals in the Broadway line to facilitate the transfer of cars from one track to the other, in case the line should be blockaded from any cause, Fig. 2, being the crossing at the intersection of Twenty-third Street. The very substantial manner in which the crossing and switch are constructed

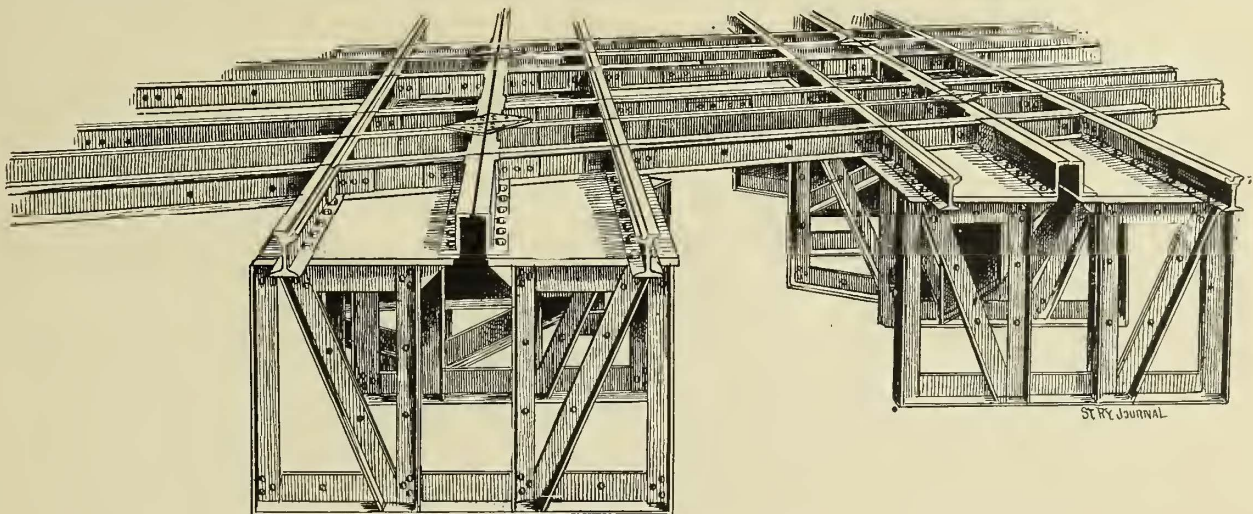


FIG. 2.—CROSSING AT TWENTY-THIRD STREET—BROADWAY (N. Y.) CABLE LINE.

motors will be capable of hauling the heaviest trams up or down a five per cent. grade, and will run through on the surface road after leaving the elevated portion. The speed on the elevated portion of the road will be thirty miles an hour, and on the surface in the thicker settled portions of the city the same as the cable, twelve miles an hour, and in the outlying districts fifteen to twenty miles an hour, thus putting people down in the heart of the city from Evanston and the surrounding territory in from thirty to thirty-five minutes."

A communication was read from R. H. Keithley, in which a comprehensive plan for providing rapid transit, was outlined. Chicago, he said, would have to adopt some such plan as had been recommended by the rapid transit commission in New York. The city needed a

is fully shown in the illustration and reflects credit upon the manufacturers.

THE United States produces 9,202,000 tons of pig iron per year, or over 1,100,000 tons more than Great Britain her greatest competitor.

A BLOCK of buildings containing the car houses and offices of the Springfield Street Railway Co., Springfield, Mass., was recently destroyed by fire. The loss to the company will probably be in the neighborhood of \$10,000.

Stomach Stones.

In "Notes from the Field" printed in our last issue, we mentioned the fact that a horse belonging to the Frankford & Southwark, Philadelphia City, Passenger Railway Co. fell dead after coming in from a trip, and on opening the stomach to determine the cause of death five stones were found which had been formed by a deposit in layers of calcareous matter, the weight of which had produced a rupture of the diaphragm. Three of these stones are illustrated in the accompanying engraving, the largest one of which weighed fifty-seven ounces and measured sixteen inches in circumference. It is represented as cut in half, showing the rings or layers quite distinctly indicated by the various tints of the stone. The animal is said to have looked like a perfect railroad horse, was medium sized, had a smooth coat, good action and had given no symptoms of the disease which caused his death.

The disease known as stone in the stomach is not a very common one with street car horses, but is most frequently found in horses employed by millers and which

railroads permit two uniformed policemen to ride free on the front platforms of cars.

Brooklyn—All officers in uniform are allowed to ride free on any street car in the city, but the number on any one car must not exceed five. Captains, detectives and sergeants are given books of tickets and yearly tickets.

Philadelphia—Policemen, in uniform, ride free; no other privileges are allowed.

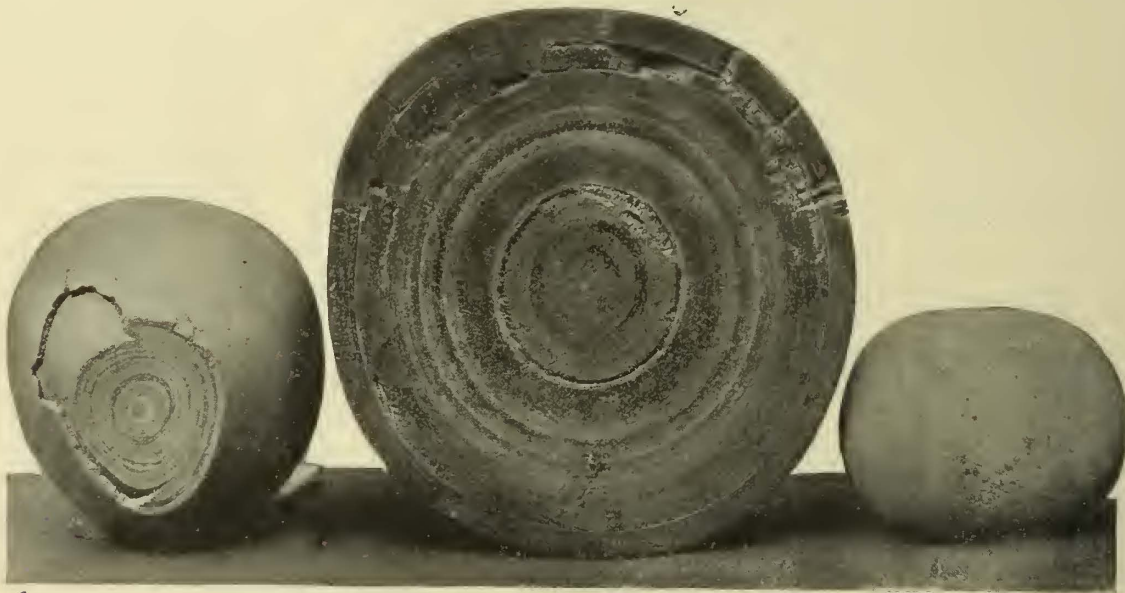
Central & North River Railroad, New York—Charges for packages; no concessions to firemen; two policemen allowed to ride free.

Twenty-third Street Railroad, New York—Policemen in uniform, up to two, free.

Cleveland City Cable Railroad—No concessions to firemen; policemen, in full uniform, ride free.

The Pullman Double Decker in Boston.

When the Pullman double decked, centre vestibule car, described in our November issue, was put in operation on the West End Street Railway, Boston, its trial was in the



STONES FOUND IN THE STOMACH OF A CAR HORSE.

are fed from the sweepings of grist mills, and is supposed to originate from small pieces of millstone or other foreign body which the animals may have swallowed with their food, and which form the nucleus around which the deposit is made. The usual symptoms of such formation are a depraved and capricious appetite and a disposition to eat the woodwork of the stable, earth or, in fact, almost any substance within their reach. Occasional colics may also result from stomach stones, and when these lodge at the outlet of the stomach they usually prove fatal. The position that seems to afford the most relief to an animal afflicted in this way is sitting upon the haunches. During the fatal attack the symptoms are those of obstruction followed by inflammation and gangrene. There is no treatment ordinarily that will prove effective.

Privileges Accorded to Police and Fire Departments.

The following is a consensus of the regulations adopted by street railway companies in a number of cities in regard to free transportation of policemen and firemen:

Boston—Policemen in full uniform, ride free when standing on the platform, but not more than two are allowed to ride free on any one car.

Chicago—Policemen, in uniform, ride free, and some in citizen's clothes ride on complimentary tickets.

Pittsburgh—Police and firemen ride free all over the lines.

Detroit—Books of 100 tickets are issued to policemen for twenty-five cents.

New York—With one or two exceptions the surface

nature of an experiment. Nothing of the kind had ever been practically used there, and it was regarded as doubtful whether the public and management would approve of the decided innovation. It was also thought by some that in the narrow and crooked streets for which Boston is noted, and through some of which the car had to pass, it would not give such good service as a shorter car might.

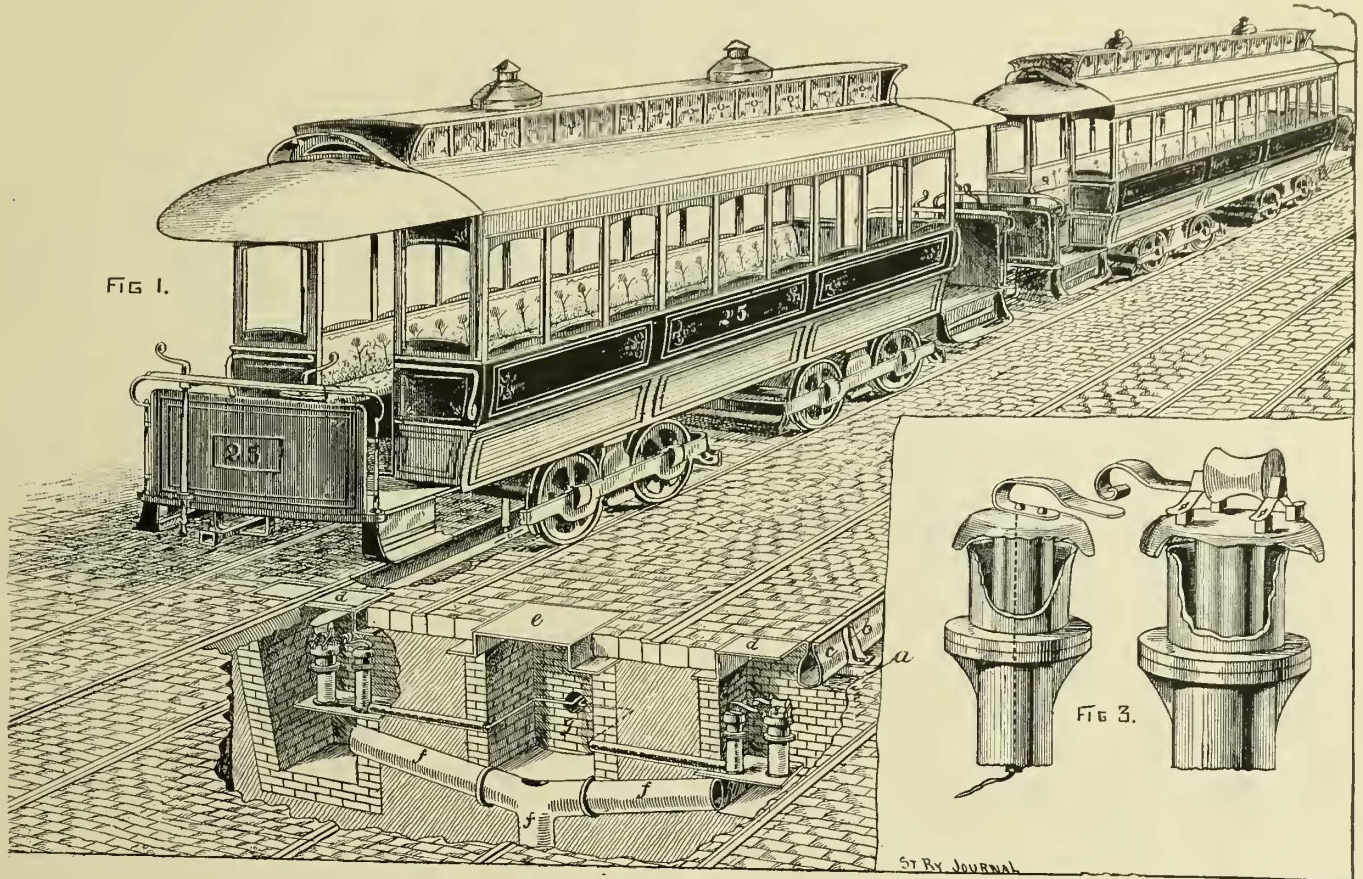
The performance of the car, however, during the month of December, when it has been in operation on the West End road, has proved the falsity of these fears and the wisdom of the management in making the test. Mr. Whitney says in regard to the car: "It gives excellent satisfaction to the public and carries more passengers than the other cars, and to that extent helps to solve the transit question for large cities." From reports taken of the actual work done by the car, the interesting fact is brought out, among other points, that more passengers are carried on the upper than on the lower deck, and this too in winter weather. The following is a statement of the actual number of passengers carried during four round trips between Harvard Square and Bowdoin Square on December 13, the mileage made being fifty-four:

TRIPS.	TIME.	Lower Deck Passengers.	Upper Deck Passengers.	Total.
First trip.....	12.05 P. M.	88	85	173
Second trip.....	1.20 "	58	109	167
Third ".....	2.35 "	136	154	290
Fourth ".....	3.50 "	133	127	260
Fifth ".....	5.05 "	73	108	181
Sixth ".....	6.50 "	92	88	180
Seventh ".....	8.05 "	57	102	159
Eighth ".....	9.10 "	73	135	208
		710	908	1,618

The Munsie-Coles Electric Conduit System.

In order to provide for an efficient system of electric traction in locations where the use of the overhead wire is prohibited, and at the same time overcome the difficulties inherent in the ordinary conduit system, the method

means of a traveling closing bar or long flexible trolley, suspended within the conduit from the car, in such a manner that in passing the friction roller is pressed down, making a spring connection with the positive wire contact point and conducting the current to the motors, the return being through the rails. The traveling closing



FIGS. 1 AND 3—MUNSIE COLES ELECTRIC RAILWAY CONDUIT SYSTEM.

herewith presented has been devised, and although somewhat more costly in the first construction than the overhead system it can be built for very much less money than any of the cable systems.

As will be seen from the accompanying illustrations, the main conductors are placed in a blind conduit between the tracks, as shown at *g*, in Figs. 1 and 2, and each track is provided with a shallow conduit, *e*, located be-

bar which may be attached to one or more cars is of sufficient length to reach from one friction roller to the next as it is necessary to make contact with the one in advance before the other is left, so that the distance between the handholes is regulated to suit the length of the trolley, Fig. 6.

The closing bar or trolley is flexible and jointed as shown at *G*, and is rigidly attached to the first support at

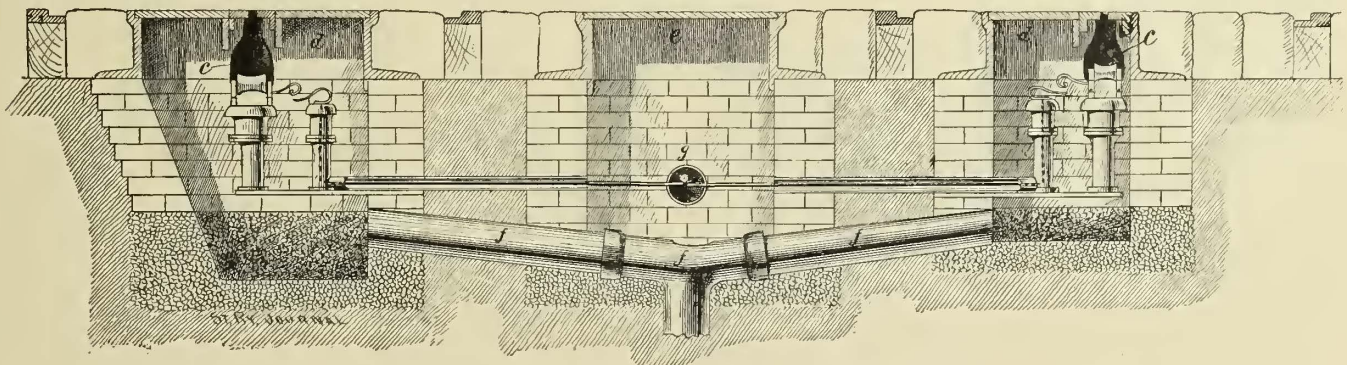


FIG. 2.—MUNSIE-COLES ELECTRIC RAILWAY CONDUIT SYSTEM.

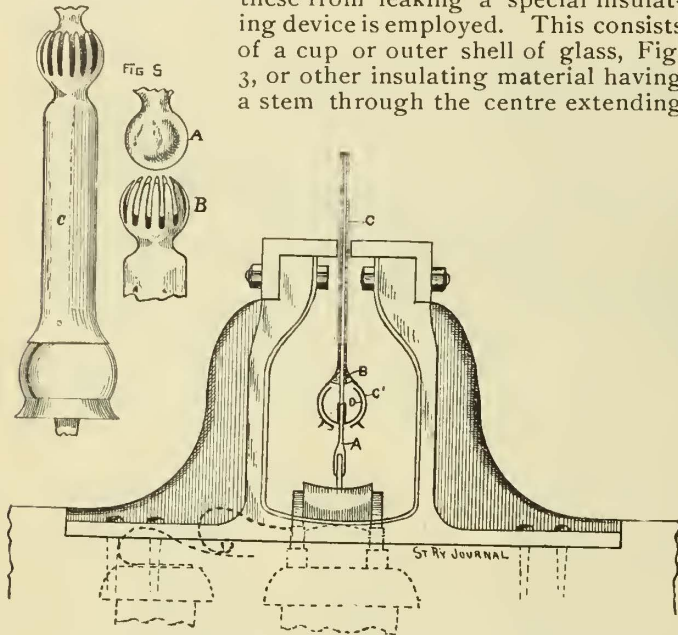
tween the rails and constructed with slot rails in the ordinary manner. The track conduits are intersected at suitable intervals with handholes, *d*, which are placed directly opposite the manhole, *c*, over the main conductor. In the handholes are placed two contact posts, one directly under and one at the side of each conduit. To the inner one of these posts, which is hollow, loops from the main conductor are led through insulating ducts, and connected with the contact point or spring on the top of the post, Fig. 3. The post directly under the slot supports a friction roller or circuit closing device which is operated by

f, but is provided with slots in which the other supports make an adjustable connection which admits of the cars being operated on curves without the bar coming in contact with the walls of the conduit. The joints are also so arranged that vertical flexure is provided when running on uneven surfaces. Switches and crossings offer no obstacles to the operation of this system, as contact posts can be placed in any situation and the trolley will adapt itself to all conditions.

The handholes and manholes are provided with suitable drainpipe which are connected at intervals with the

sewer, and the handholes are made a little lower than the drain pipe to provide for the accumulation of solid matter which can be removed by the linemen.

From the description it will be seen that the contact points on top of the inner posts are the only exposed bare points in the whole length of the circuit, and to protect these from leaking a special insulating device is employed. This consists of a cup or outer shell of glass, Fig. 3, or other insulating material having a stem through the centre extending



FIGS. 4 AND 5.—MUNSIE-COLES ELECTRIC CONDUIT SYSTEM.

higher than the cup which supports an overhanging cover which is designed to prevent dirt or moisture from falling into the cup, while at the same time it gives the necessary break between the cover and cup. The space between the outer shell and stem is filled by an absorbent which is designed to keep the stem and under side of the cover dry in all conditions of atmosphere. The friction rollers, it will be noted, are not charged except when the trolley is passing, and hence, will not form a

and prevents rain or mud falling on the latter, and at the same time prevents any rapid change of atmosphere about the absorbent, so that there would seem to be little chance for the current to escape while being conducted to the motor.

The method of attaching the trolley hanger to the truck is shown in Fig. 5, and consists of a hollow ball, *a*, firmly attached to the truck to which the hanger proper, *c*, is attached by means of metallic fingers, *b*, which grip the ball with sufficient hold to support the weight of the contact bar, but so arranged that in case the car should become derailed they will spring loose from the rigid ball and prevent injury to contact bar and connections.

It will be observed that the yokes and conduit are so constructed that the paving blocks may be laid firmly against them, and the conduit being shallow the cost of construction will be much less than the conduits heretofore constructed. The device is controlled by the Munsie-Coles Electric Railway Equipment Co., of New York City, from whom further particulars may be obtained.

Electric Postal and Express Cars in St. Louis.

St. Louis is the first city in the United States, and thus in the world, to put into operation special cars devoted to an electric postal and express service. Negotiations have been progressing for some time past between the street railway companies of St. Louis and Major Harlow, postmaster of the city, for adopting an extensive postal system on the existing lines which are most in need of such an innovation. Major Harlow has had several interviews with Postmaster General Wanamaker in regard to the scheme, and the latter gentleman has been heartily in favor of it since the subject was first broached to him. The Major is also enthusiastically in favor of it, which is evidenced not only by what he has to say on the subject, but by his untiring efforts to make some arrangement with the street railway companies.

The reasons for wanting postal street cars to do service are apparent to all, and to St. Louisans especially. The city of St. Louis occupies a territory of sixty-two square miles, or more than the area of the District of

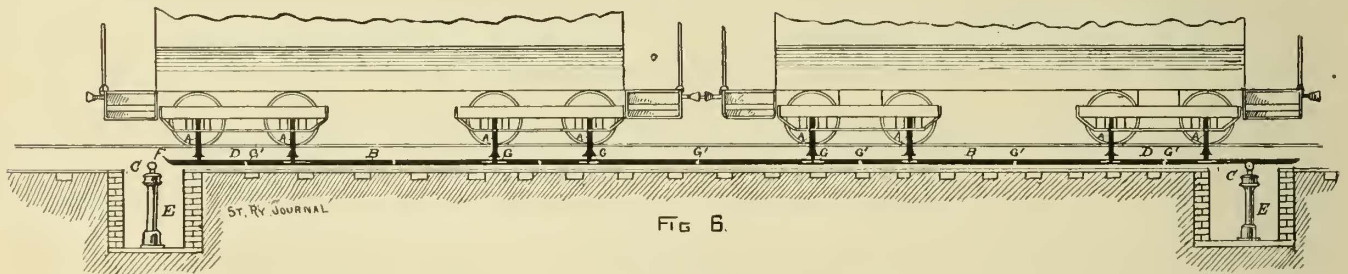


FIG. 6.

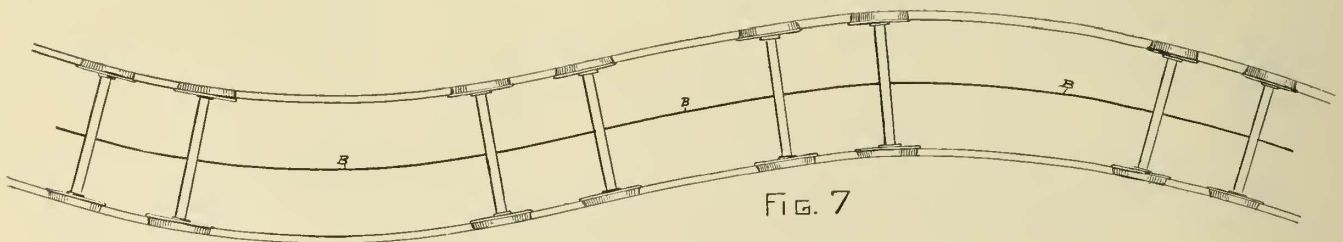


FIG. 7

MUNSIE-COLES ELECTRIC CONDUIT SYSTEM.

ground should a piece of wire or any other conductor fall on to it through the slot.

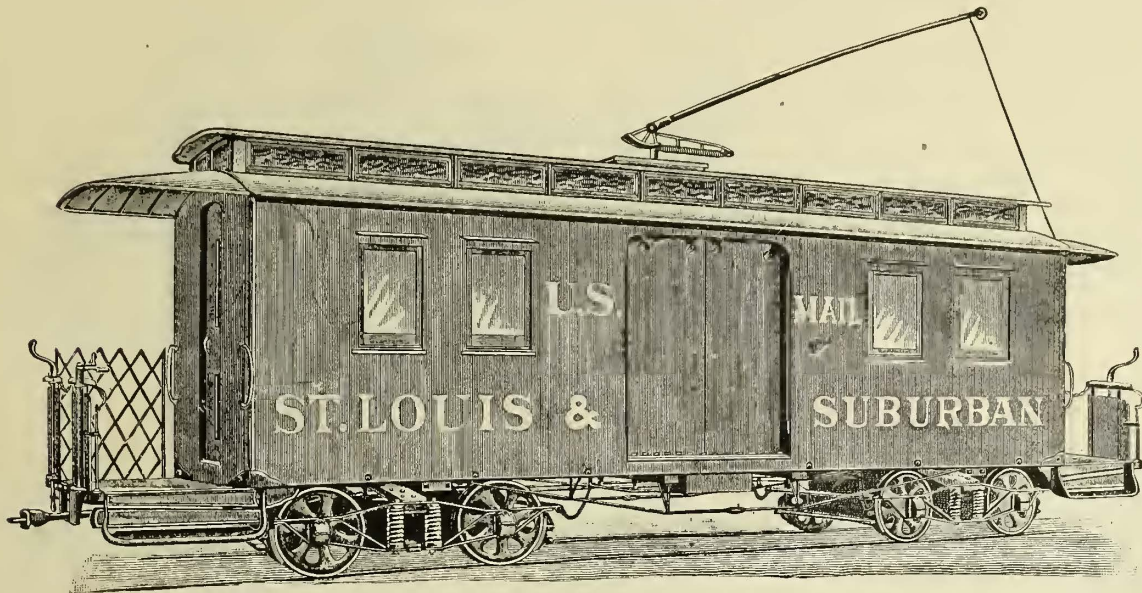
A cross section of the hanger or supporting arm of the traveling contact bar is shown in Fig. 4, and is so constructed as to prevent the conductor from coming into contact with the slot rails. As will be seen, the shank is composed of a conductor, *a*, forming the centre and covered by an insulating material, *b*, which is enclosed in a metallic shield, *c*, which protects the insulation from wear on the slot rails. A glass cup, *d*, is fitted to the conductor having a triple perforated cover designed to enclose an absorbent to protect the conductor from moisture; *e* is a detachable metallic shield which fits over the glass cup, *d*,

Columbia. Within these limits are the central post-office and five sub-stations, or, there is one post office to every ten square miles. It is very evident that the number is not sufficient to accommodate the public. In consequence, there are many complaints about the time required by a letter to get from one part of the city to the other, and to do away with all trouble the adoption of postal railway cars on the street railway lines of the city has been suggested.

Major Harlow's plan in running these cars is as follows: Along the proposed route there are to be established at least forty sub-stations. A whole car; or an apartment in a car is to be fitted up in the same man-

ner as in a postal car for steam roads, with all the necessary pigeon holes for letters, etc., and be run upon a regular schedule. When the city mails are to leave the central post office each bag is to be designated for a certain sub-station, and the number of bags to be put on each car is to be attended to by a clerk familiar with that part of the city through which the car runs, and whose duties also include delivering to each sub-station

The car on the southern railway running to Carondelet does an express business only. It is a temporary affair, but has been running for some time past. It will be replaced very soon by a fine car, somewhat similar to the one on the St. Louis & Suburban. It is different from the latter car in one detail, that is, the narrow door at each end is done away with, and in its place are substituted two swinging doors placed a little to one side,



U. S. ELECTRIC MAIL CAR—ST. LOUIS & SUBURBAN RAILWAY CO.

for accommodating long pipes or lumber in case long material of this nature should be expressed to anyone. There is no dasher, but the ordinary iron grab handles and posts are used as on a railroad car. The car makes two trips a day, at eleven A. M. and five P. M. The St. Louis & Suburban car is divided up, one part being provided with the ordinary facilities for handling mail matter, such as pouches, pigeon holes, etc., and the other for the express and baggage. Express matter to be

sent to Carondelet or intermediate points is delivered at the 'South St. Louis Electric Express Office,' corner 6th and Market Streets, the downtown terminus of the line, and is put on the car, which delivers to all the sub-stations between the termini of the line. At these sub-stations packages are delivered to their owners by the express agent.

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An Adjustable Step for Trail Cars.

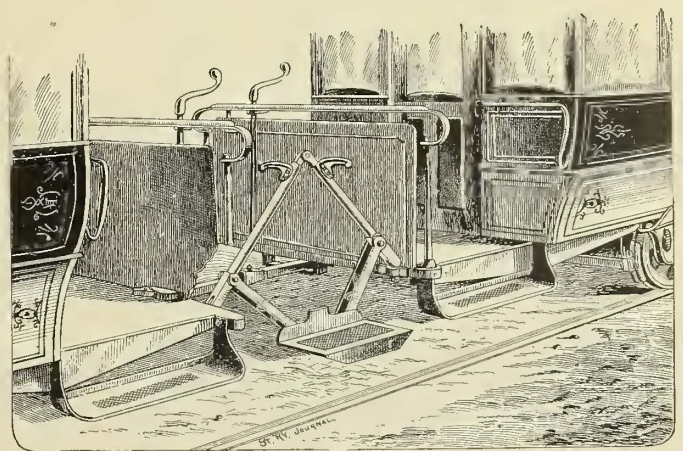
In the accompanying illustration is presented a device to provide for easy communication between motor and trail cars. As will be seen from the illustration, the device consists of a platform of cast iron or

the bag or bags belonging to it, and while the car is in progress receiving whatever mail matter is given him through the mail box provided on the car. This arrangement will insure an exchange of mail matter between all the sub-stations. After the bags are left at each sub-station the carriers receive the letters belonging to their routes, and after delivering them return to the sub-station with all mail matter they have collected from mail boxes and individuals, which will be in readiness for the car on its return trip to the central post office. This would do away with all necessity of the postmen making several trips to the central office each day, and would mean a saving of from eighty to 100 hours per day, the equivalent of an additional force of ten or twelve postmen.

This arrangement, it is almost needless to say, outside of all the convenience it would afford the public, would certainly prove of pecuniary benefit to our government. The increase of the mails, from minor improvements in the mail service of the past, goes to show that the above arrangement would increase our mails to a very considerable amount.

The street railway managers and the postal authorities, however, have come to no definite agreement as yet. Postmaster Harlow claims that the remuneration demanded by the street railway companies puts out of the question the adoption of the system, and this, too, although the street railway managers say that they will derive no pecuniary benefit from their part of the contract.

The postal car in use on the St. Louis & Suburban road does both a city and a country business in handling mail matter. The route of this company extends from Sixth and Locust Streets, St. Louis, to Florissant, St. Louis County, sixteen miles from the city, and the mail car supplies it as well as all the intermediate post offices, as on a steam railroad. In fact, as the road was a steam one before electricity was adopted, it devolved upon the electric cars to do the work of the steam cars. The car shown in the illustration was made by the St. Louis Car Co. The body is thirty-four feet long, width eight feet four inches, height when mounted on trucks, eleven feet four inches. The trucks are St. Louis Car Co.'s No. 5, and on each is mounted a fifteen H. P. Thomson-Houston S. R. G. motor. The total weight of the car is about 16,000 lbs. It not only carries the mails, but baggage, express packages, and dairy products. It makes two trips per day one in the morning and one in the evening.



COBB'S ADJUSTABLE STEP.

other material so hung from two hinged arms that it is maintained on nearly the same level as the steps of the adjacent cars. The supports are made of gas pipe and provided with brass handles near the top on the same level with the hand rails which serve as a firm and convenient support for the hand of the passenger or conductor while crossing. The step is prevented from swinging by means of two small links, not shown in the engraving, which are connected with a bolt designed to move in a vertical slot back of the step.

The bridge is supported in such a manner as not to

be affected by the side sway of the car and readily adjusts itself to the varying distance between the cars. It is claimed that the position of the bridge between the platform steps is safer and more convenient than if it were on a line with the centre of the car, as in this case it would require an opening in the dashboard, which might become a source of danger in case the gate should be left open. The use of the bridge does away with one of the chief objections to operating trail cars, for it is often the case that one car will be overloaded when there are plenty of vacant seats in the other car, but cannot be utilized on account of the difficulty and danger in passing from one car to the other, an exasperating condition that often faces the tired man of business. This step seems to obviate many of the difficulties, and will materially assist the conductor in collecting fares, while it relieves him of the great risk incurred in attempting to pass between cars as ordinarily operated. Further particulars regarding the device may be had by addressing the inventor, Arthur Cobb, Louisville, Ky.

Electric Car Snow Plow.

A snow plow for electric cars, designed to be readily attached to and detached from the motor car, has recently been placed upon the market by the Wales Manufacturing Co. of Syracuse, N. Y., and is shown in the accompanying engravings. A number were in use on different electric railways last winter, and proved eminently satisfactory.

There are no wheels on the plow to jump the track, but, instead, the fore part of the plow rests upon the rail by means of a heavy half round shoe of boiler plate which slides along the rails and allows the plow to pass



FIG. 1.

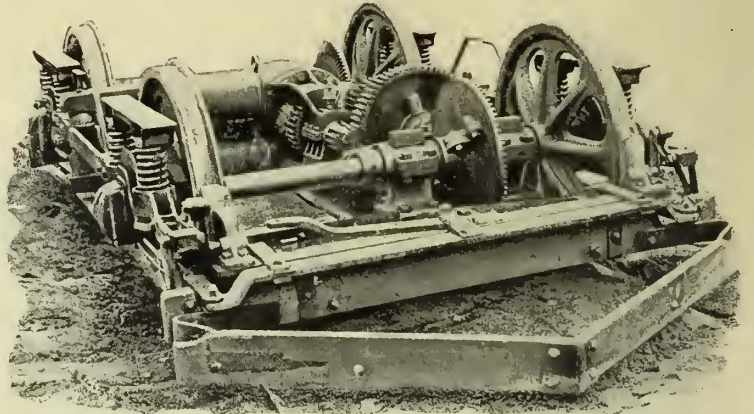
WALES ELECTRIC SNOW PLOW.

over frogs, crossings, etc., without difficulty, as shown in Fig. 2. The plow is provided with an iron nose which can be raised or lowered and can be used as a scraper where the track is sufficiently high above the paving. The plow weighs 350 lbs., and can be easily handled and moved from end to end of car by two men. The method of attaching to car is shown clearly in both of the engravings.

THE Pelton Water Wheel Co. have installed at Laxa, Isle of Man, an overshot wheel 110 ft. in diameter.

Device for Economizing Power on Grades.

It is a well known electrical principle that in order to obtain the greatest efficiency from an electric motor the armature must be run to its maximum speed, and hence, since motors in climbing steep grades slow down about fifty per cent. an enormous amount of current is consumed without an equivalent in motive power. It cannot be ex-



THE GOSS DEVICE FOR ECONOMIZING POWER ON GRADES.

pected that an electric car will climb a steep grade at the same speed at which it will run on a comparatively level track, but while the speed of the car is necessarily reduced it is desirable to run the armature to its maximum speed.

The accompanying illustration shows a method of connecting armature with wheels in such a manner that the speed of the armature can be made uniform on level tracks or grades. A single motor is shown, mounted on a Bemis truck, and, as will be noticed, the armature shaft is provided with two pinions of different diameters which mesh into gears of correspondingly different diameters on the countershaft which in turn communicates power to the axle by means of beveled gears. The gears of the countershaft are provided with clutches to be operated by a lever from either platform, by means of which the driver

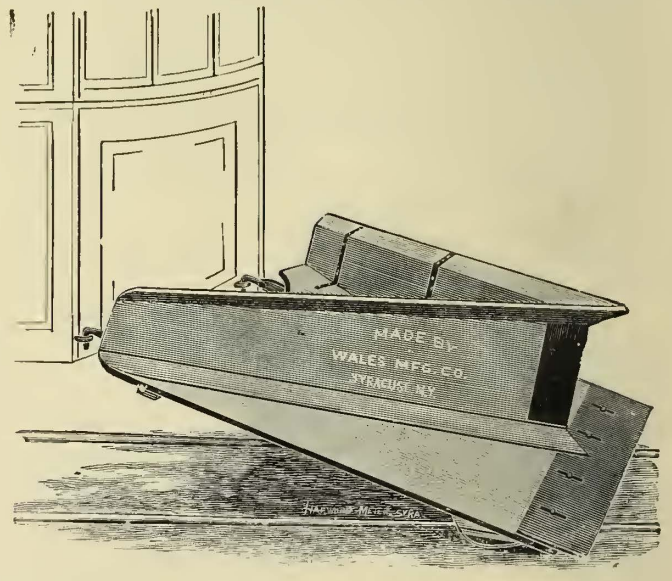


FIG. 2.

can use either the large or small gear, or throw them both out of mesh so that the motor can run without moving the car. By employing the small pinion on heavy grades great power is obtained, while only a comparatively small quantity of current is required. When running on a level track where high speed is required the large pinion is employed. With this device it is claimed that no more current is required to run four miles an hour on grades than to run at sixteen miles on a level track. This device has been operated experimentally for about a year, and its claims are said to be sustained. In

a comparative test on an eleven per cent. grade with two other cars, one equipped with two fifteen H. P. motors and the other with two twenty H. P. motors of the double reduction type, the truck above described, with tow cars, consumed only fifty-nine amperes, while the other cars took seventy-eight and eighty-four amperes respectively. On a five mile road where the above tests were made it requires an eighty H. P. generator to operate two cars. With the new equipment it is thought three or four cars could be operated with the same amount of current. Further particulars may be obtained by addressing the inventor, E. W. Goss, Amesbury, Mass.

The Hathaway Belt Power, Hydraulic Wheel Press.

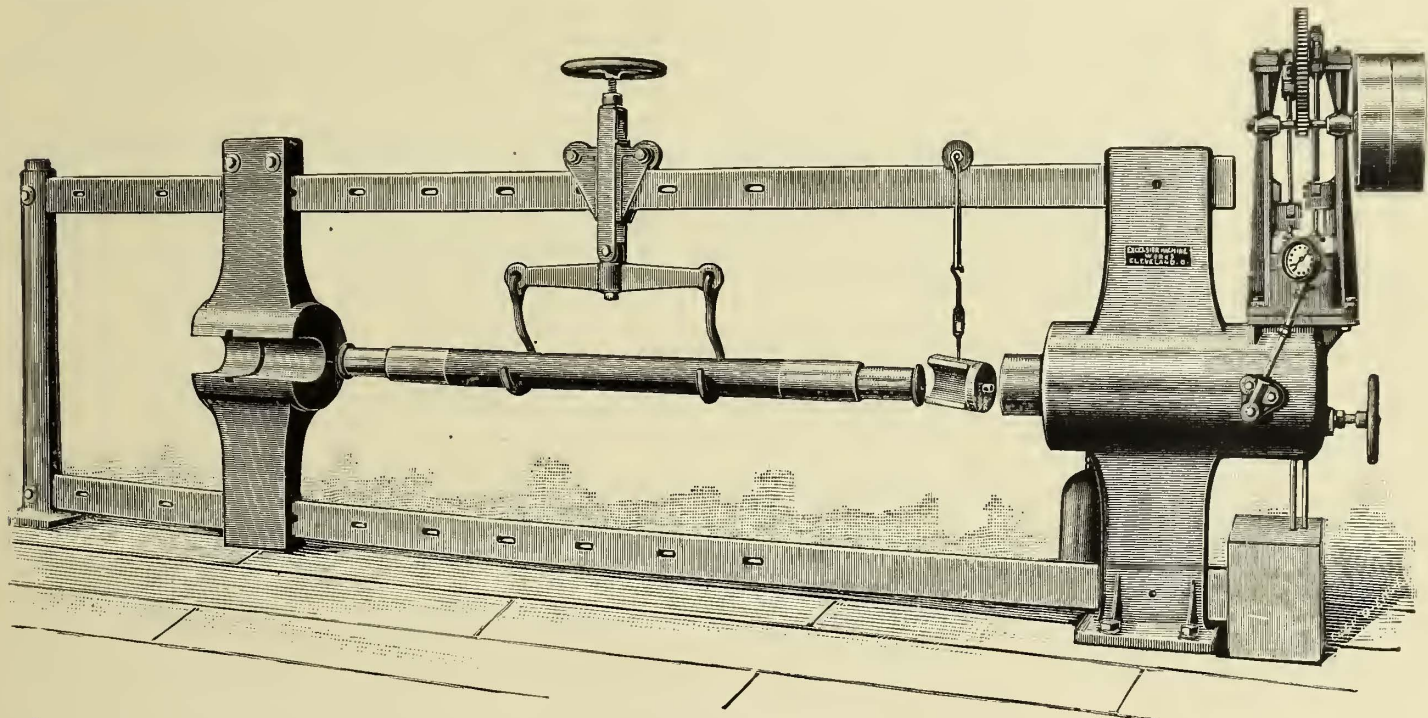
A wheel press is always a desirable and very often a necessary part of the equipment of every street railway. One of the most convenient machines of this kind which has been brought to our attention is one which is illustrated in the accompanying engraving, and is manufactured

three and one-half inch face. The press can exert a pressure of fifty tons.

Rapid Transit Plans in Boston.

The subject of underground rapid transit in Boston has been the topic of several interesting addresses recently by Henry M. Whitney, president of the West End Street Railway Co. in that city.

In an address made before the Rapid Transit Commission December 7, in connection with this subject, Mr. Whitney showed by a series of figures the rapid increase during the last ten years of the number of passengers brought in and carried away from the city by the steam railways, as well as those transported by the surface lines within the city. In 1880 the aggregate number of passengers carried per day by the street railway lines on the north side from Cambridge, East Middlessex and East Boston was 51,000, and the number carried by the steam roads was 30,000. On the south side the numbers were respectively 114,000 people by the street rail-



THE HATHAWAY WHEEL PRESS.

by Alfred G. Hathaway of Cleveland, whose transfer and turntables and other articles of car house equipment are well known among street railway managers. As will be seen, the pump is attached to the framework of the press and can be set longitudinally, as shown, or transversely with the ram so as to suit the condition of the shop shafting, enabling the user to locate his press at any desired place.

The pump is of the duplex pattern with single acting plungers, the gearing being five to one. The plungers are packed with compressive fibrous packing with bolted gland which is tight and works with no undue friction. The pump barrel is made in one piece from hammered steel. The suction and delivery pipes are large, perpendicular and easy of access by separate bonnets situated on top of the pump barrel. The movable beam runs on rollers upon the top bar, and is recessed so that blocks may be placed in each of sufficient thickness as to act as a template in forcing on car wheels. A swing chuck placed against the ram acts as a template for the other end of the axle. The block can also be used when forcing shafts into wheels. Return weight, water tank, safety valve and pressure gauge are also furnished.

These hydraulic presses are manufactured of sufficient size to take wheels of thirty-six inches in diameter, and they have a distance between bars of forty-one inches. The tight and loose pulleys are fifteen inches in diameter and turn at 150 revolutions per minute, and have each a

ways and 30,000 by the steam roads, making for 1880 a total of 225,000 people brought into and carried from the city each day. Mr. Whitney showed that in 1890 the traffic had absolutely doubled over every line then running, including the steam roads.

The growth of the street railway business is shown by the fact that in 1880 the roads now under the West End system carried 59,000,000 passengers. The following year they carried 63,000,000, the next year they carried 69,000,000, the next year 71,000,000, the next year 76,000,000, the next year 80,000,000, the next year 86,000,000, the next year 91,000,000, the next year 97,000,000, the next 104,000,000, the next year 114,000,000.

Mr. Whitney then, after referring to the advantages to the city of having a transit system which could efficiently and cheaply care for this immense and growing traffic, detailed his plan for facilitating the work of transportation. This plan provides, in addition to the present surface lines, for a tunnel under the Common, commencing on the south at the junction of Tremont and Warren Streets and emerging at Adams Square. This preserves the line of travel as it at present exists, and when public necessity and convenience may require the development of an elevated railroad, provides a system which can be readily adapted to the new conditions. While confident of the desirability to the city of the execution of the plan as outlined, Mr. Whitney stated that he desired it thoroughly understood by the Commission that the West

HARRISON STREET RAILWAY COMPANY.

REPAIRS.		HORSES.		FEED.		HORSE SHOEING.		SALARIES.		WAGES.		LIGHT AND FUEL.		OFFICE EXP.		SNOW AND ICE.		CONDUCTORS AND CAP.		RENTALS.		DAMAGES TO PERSON AND PROPERTY.		LEGAL EXPENSES.		TAXES.		INTEREST.		MISCELLANEOUS GENERAL EXPENSES.		
Unclassified. Each Item to be Posted Separately	Buildings and Fixtures.	Cars.	Track and Road Bed.	Harness & Stable Equipments.	Purchase of Horses.	Including Expense of Grinding.	Labor and Materials.	Officers and Clerks.	Conductors and Drivers.	Detectives, Car Cleaners, Watchmen, Starters, &c.	Light and Fuel.	Office Exp. Advertising, Stationery, Telephone, Incidentals.	Snow and Ice.	Conductors Coat and Cap.	Tracks.	Real Estate.	Damages to Person and Property.	Legal Expenses.	Taxes.	Interest.	Miscellaneous General Expenses.											
	Cr.	Dr.	CASH.	Dr.	CASH.	Dr.	CASH.	Dr.	CASH.	Dr.	CASH.	Dr.	CASH.	Dr.	CASH.	Dr.	CASH.	Dr.	CASH.	Dr.	CASH.	Dr.	CASH.	Dr.	CASH.	Dr.	CASH.	Dr.	CASH.	Dr.	CASH.	
DATE.	RENTALS.		WAGES.		HORSE SHOEING.		SALARIES.		CONDUCTORS AND DRIVERS.		LIGHT AND FUEL.		OFFICE EXP.		SNOW AND ICE.		CONDUCTORS AND CAP.		RENTALS.		DAMAGES TO PERSON AND PROPERTY.		LEGAL EXPENSES.		TAXES.		INTEREST.		MISCELLANEOUS GENERAL EXPENSES.			
	TOTALS.		TOTALS.		TOTALS.		TOTALS.		TOTALS.		TOTALS.		TOTALS.		TOTALS.		TOTALS.		TOTALS.		TOTALS.		TOTALS.		TOTALS.		TOTALS.		TOTALS.			
	Amounts brought forward.		Amounts carried forward.		Amounts brought forward.		Amounts carried forward.		Amounts brought forward.		Amounts carried forward.		Amounts brought forward.		Amounts carried forward.		Amounts brought forward.		Amounts carried forward.		Amounts brought forward.		Amounts carried forward.		Amounts brought forward.		Amounts carried forward.		Amounts brought forward.		Amounts carried forward.	

End Street Railway Co. could not undertake to work unless the State were willing to strengthen its hands by the removal of the danger of hostile legislation. The knowledge of the reasonable security of their investments would be the only condition, Mr. Whitney thought, upon which money could be enlisted from capitalists for the enterprise, and he urged upon the commission the desirability of some measures by the legislature by which the result would be obtained.

Forms for Keeping Street Railway Accounts.

We are frequently asked to give simple and convenient forms for keeping street railway accounts, and in the accompanying blanks we present the first and second pages of a cash book as copied direct from one in use by a prominent street railway company operating in the State of New York. From these pages the posting may be done directly to the ledger without journalizing, and the forms will be found to give a very satisfactory classification of accounts for horse railways, and can be easily modified to be used on lines employing mechanical traction. The pay roll account is shown as follows :

HARRISON STREET RAILWAY CO.

..... 189.....	
PAY ROLL NO.....	
WAGES—Conductors and Drivers.....	.....
“ Clerks.....	.....
“ Starters, Inspectors.....	.....
“ Watchmen, Switchmen, &c.....	.....
“ Repairs, Cars.....	.....
“ “ Harness.....	.....
“ Shoeing.....	.....
“ Feed.....	.....
“ Light and Fuel.....	.....
REPAIRS—Building and Fixtures.....	.....
“ Track and Roadbed.....	.....

In this connection we present on the following page the blank prescribed by the railway commissioners for the State of New York, on which the quarterly reports of all street railway companies in the State are required to be made. This blank will also help in the classification of accounts. The subject of the standard method of keeping accounts received special attention in a paper read at the last meeting of the American Street Railway Association, and a committee was appointed to recommend to the Association, at its next meeting, forms that may be adopted as standards by railroad companies in all parts of the country.

SPANISH cedar is becoming a very popular finishing wood on the Pacific coast, largely taking the place of redwood, to which it is superior because of its hardness and susceptibility to a high polish. The wood is expensive, however. It comes from Mexico and Central America, the finest from the last named country. The cedar grows on mountain sides and along streams and creeks. The primitive methods employed in logging makes the cost of the cedar from \$75 to \$80 per thousand landed in San Francisco in the log. Spanish cedar, it is believed, will take the place of mahogany.—*The Mississippi Valley Lumberman.*

A SERIOUS accident occurred December 7 on the cable road at Belleville, a suburb of Paris. The grip slipped, and as the brakes would not work properly the car descended the hill, upon which it was, at a high rate of speed and collided with a car which was ascending at that time. All the passengers in both cars were more or less hurt, and twelve of them received injuries which were very serious.

ail Company.

STATEMENT of the Earnings, Operating Expenses, Deductions from Income and Net Income for the Quarters ending 18..... and 18

18				18			
.....				.....Gross Earnings from Operation,.....			
.....				.....Operating Expenses (excluding all Taxes).....			
.....				.....Net Earnings from Operation.....			
.....				.....Income from other sources than Operation.....			
.....				GROSS INCOME FROM ALL SOURCES.....			
.....				Deductions from Income as follows :			
.....				*Interest on Funded Debt.....			
.....				*TAXES, { On property used in Operation of Road.....			
.....				{ On Earnings and Capital Stock.....			
.....				{ Other than above.....			
.....				*Rentals.....			
.....				NET INCOME FROM ALL SOURCES.....			

Operating Cost....per cent of Earnings (excluding all Taxes).	Operating Cost....per cent of Earnings (excluding all Taxes).
Operating Cost....per cent of Earnings { including Taxes on all property actually used in Operation of Road and on Earnings and Capital Stock.	Operating Cost....per cent of Earnings { including Taxes on all Property actually used in Operation of Road and on Earnings and Capital Stock.

GENERAL BALANCE SHEET.

18

<i>ASSETS.</i>				<i>LIABILITIES.</i>			
Cost of Road and Equipment.....				Capital Stock, Common.....			
Stocks and Bonds of other Companies.....				Capital Stock, Preferred.....			
Other Permanent Investments.....				Funded Debt.....			
Supplies on hand.....				Loans and Bills Payable.....			
Accrued Interest.....				Interest on Funded Debt Due and Accrued.....			
Due by Agents of this Co. on account of Traffic.....				Dividends Unpaid.....			
Due by others (not Agents of this Company) on account of Traffic.....				Due for Wages and Supplies.....			
Due by Companies & Individuals (on open Accounts other than Traffic).....				Due Companies and Individuals (on open accounts).....			
Cash on hand.....				.....		
.....						
Profit and Loss (Deficiency).....				Profit and Loss (Surplus).....			

.....being duly sworn, deposes and says that he is.....
of the.....Company; that the foregoing Quarterly Statement
and General Balance Sheet are true and correct to the best of his knowledge and belief.

Sworn to before me, this..... }
day of.....18..... }
Address.....

NOTES: *Enter proportion for this quarter, of the annual amount, whether paid or not.
Fill in all dates and cost of operating as called for above, and where there is nothing to enter under any item, so designate by a cipher.
On the above Quarterly Statement enter figures for the current Quarter on the right side, and for corresponding Quarter of previous year on the left side of this sheet.
Where no separation is made in Assessments between "Property used in Operation" and property not so used, all Taxes as Assessed may be returned as upon "Property used in Operation."
The General Balance Sheet is to be a condensed transcript of the General Ledger as it stands on March 31, June 30, September 30 and December 31 of each year, and must show the exact financial condition of the Company on those dates.
Interest on Funded Debt which has accrued, but may not be due, as well as that which is due and unpaid at the close of the Quarter, must appear on the Balance Sheet as a Liability.

The Street Railway Situation in Chicago.

If a Chicogoan were asked what question is exciting the greatest interest in his city at the present time, he doubtless would reply, "the street car problem." The topic certainly seems to take precedence over all local matters. It is the subject of a vast number of editorials usually vehement in character; it occupies the most prominent position in the news columns; it comes before the City Council in a variety of forms, and it has formed the subject matter for innumerable interviews with Mayor Washburne, who has dealt with it in at least one special message addressed to the aldermen.

Chicago unquestionably needs additional transportation facilities. The public realizing this fact must of necessity find an object for attack, and the surface roads naturally come in for practically all the abuse and criticism distributed lavishly by the public representatives. The general charge laid at the doors of the local companies is inadequacy of facilities. The other accusations, urged with bitterness, need but a brief reference. They are of the general character always brought against corporations which deal with the public.

An extract from Mayor Washburne's message will throw some light on the situation. He says:

"It having come to your knowledge and to the knowledge of the administration that the present facilities rendered the public for passenger transportation within the city are wholly inadequate, and in view of the fact that the World's Columbian Exposition will soon add very greatly to the demands of travel in all parts of the city, it is desirable that radical and immediate steps be taken to remedy the evil."

The question naturally arises, in what way was the present state of things brought about? The liberal policy of Chicago roads in extending their lines and in increasing their facilities, has been recognized throughout the country. Millions have been expended in cable construction, and in the purchase of rolling stock; yet at the present time they cannot handle comfortably the enormous traffic which demands accommodation.

It is not necessary to search long for the chief cause. The street car interest, like many another interest, has been overtaken by an increase of population entirely beyond expectation. But are the companies doing all that can be expected of them? The press of the city answers by an emphatic negative, but its opinions are expressed in such bitter, uncompromising terms that one cannot be impressed by the impartiality of its decisions. The STREET RAILWAY JOURNAL has taken considerable trouble to investigate the question, and the results are given herewith.

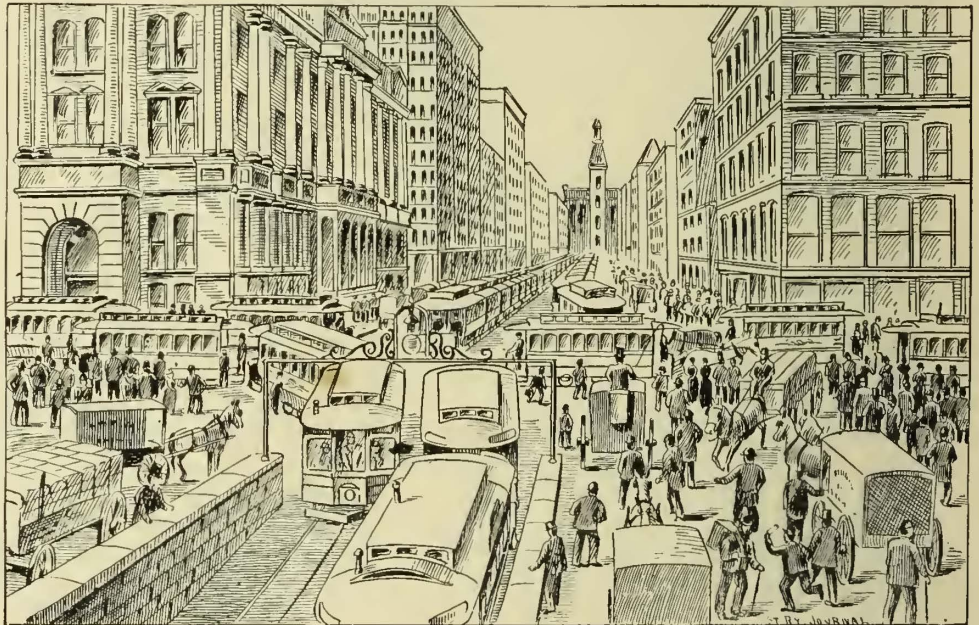
Any one who will visit the downtown loops of the several companies will find that during the "rush" hours at night and in the morning they are crowded by cable trains almost touching each other all around the circuit. The Chicago City Railway Co. which operates the roads on the south side of the city is so crowded on its downtown loop that its cars form almost a blockade each evening. Cars from its two main lines use the same loop. The demand for transportation has been increasing so enormously that at the present time the single loop is wholly inadequate. As a result, a solid line of cars, each waiting for its turn to enter the loop, may be seen each evening extending on both State Street and Wabash Avenue for four or five blocks.

No one realizes better than the company itself, its need for additional loop facilities, but the City Council refuses to accede to its request for a new loop. The aldermen wish either to force the company to use an inconvenient loop or to impose impossible conditions. Should

the permission for a new loop be granted, the South Side company states that it can afford the public all the surface facilities needed. This statement was made by General Manager Wheeler to a representative of the STREET RAILWAY JOURNAL. "Grant us the loop," he said, "and we can comply with all the demands made upon us in the next few years. At present we can do no more. We are now sending around the loop all the cars that can run on it. We are now sending out so many cars at night that they fairly blockade Wabash Avenue and State Street. Under such circumstances no good is accomplished by adding cars. They would simply wait their turn to pass around the loop. If we are granted the permission we will begin work at once."

"When do you expect the petition will be granted?" was asked.

"I can't tell that. It will be granted some time, I think. Meanwhile we must do the best we can. Of course I do not mean to assert that with a new loop we could give every one a seat at six o'clock at night, but we could meet all reasonable demands."



STREET SCENE AT ENTRANCE TO TUNNEL, CHICAGO

What has been stated explains the situation very completely so far as the South Side is concerned. Perhaps the bitterest complaint has been made of this company of late; yet it is prevented by the City Council from taking any steps to improve its service.

The West Side road has come in for its full share of abuse, yet officers of the company say it can handle all the traffic which comes to it. During the last four years it has increased its facilities so it can handle twice or three times the number of passengers which could be carried at the beginning of that period. For example, the cars on the Milwaukee Avenue line were making 45,000 miles a month when the present company assumed control four years ago. At the present time the mileage is 90,000 each month. The mileage run on the Madison Street line, the most largely patronized route, has been more than doubled during the last four years and increases are constantly making.

To provide for the demands of the people of the West Side, the company has built twenty miles of road during the last four years. It wished to build considerably more but the hostility of the last city administration prevented the company from beginning work. There are now pending in the City Council ordinances providing for the construction of forty miles of line. This includes extensions of existing lines and the construction of crosstown lines of which the West Side has none worth mentioning. Whether these ordinances will be passed or loaded down with such conditions that they cannot be accepted remains to be seen. What the attitude of the present city government is has not yet been ascertained. Citizens

whose property will be benefited or whose convenience will be enhanced are making strenuous efforts to secure the passage of these measures.

It has been stated that the West Side company has been charged with furnishing inadequate accommodations. It has also been charged that the cable system was defective. These matters were called to the attention of General Manager Parsons of the West Side company, and he consented to make a statement for the STREET RAILWAY JOURNAL.

"We have had," said he, "a series of misfortunes from broken grips and from employes running into switches. It has been unfortunate that these accidents occurred at the time of the 'rush' trips morning and evening. They have not been the result of any defects in the cable system. The facts have been grossly exaggerated, although, of course, delays have in some cases occurred. The newspapers seem to find it necessary to take a 'shy' at us every so often. Now, to illustrate: In last Thursday's *Tribune* mention was made of an accident causing a delay of forty-five minutes. As a matter of fact the delay

The delays and breakdowns on the North Side can be explained, as Mr. Parsons explains them, in the case of the West Side. They have been exaggerated by the local papers as much in one case as in the other. One of the officers of the road, in speaking of the charges made by the press, said to the writer recently, "You realize the falsity of the charges as well as I do. They are all included in the word 'buncombe.'"

Mr Yerkes's attention was called to the question of inadequacy by a representative of the STREET RAILWAY JOURNAL. He said: "We are abundantly able to handle the traffic. We have power enough to meet all demands for the next five years, but we shall have to increase the rolling stock."

The situation, as it exists to-day in Chicago, can be judged from what has been written. It may be summed up in a sentence: The street railway companies are doing everything in their power to serve the public, but a sufficient number of cars cannot be run on the tracks to accommodate the vast number of people who wish to ride at certain hours of the day.

It is not the purpose of this article to show where the remedy lies. A public commission has that matter under consideration. It may be well to quote again from Mayor Washburn's message, to show that his opinion is not entirely different from that which has been expressed here. He says:

"It is plain that the facilities of the present surface roads, even if they were improved to the point of perfection, are insufficient to care for the rapidly growing population, and their inadequacy will become more marked each year. Your honorable body has granted ordinances to two elevated railroad corporations in this city, both of whom have partially constructed their roads. For many months both these companies have remained apparently idle, and appear to be taking no steps to perfect their roads and grant to the public a service which they are in duty bound to provide as soon as practicable."

In view of all these facts Mayor Washburne determined to appoint a commission "with the view of having a comprehensive report upon this, to-day, all important problem, and which will lay before the administration and the public the difficulties to be met and the obstacles to be overcome and the best means to overcome them."

The commission, which includes aldermen and citizens of the several divisions of the city, and representatives of the street car companies, is as follows: On the part of the City Council from the South Division, William R. Kerr and Anson Gordon; for the West Division of the city, Robert L. Martin and Edward F. Cullerton; for the North Division of the city, Austin O. Sexton and Peter J. Biegler. The citizens appointed upon this committee for the South Division are D. V. Purington and N. B. Ream; for the North Division, C. K. Corbin and Washington Hesing; and for the West Division, A. J. Stone and Frank Stauber. The North and West Division street railway represented by Charles T. Yerkes and the South Side Cable lines by G. H. Wheeler. The chairman is Austin O. Sexton.

WHAT is said to be the largest girder in the world was placed in position, December 20, over the Mattabeset River at East Berlin, Conn. It is 102 ft. six inches long, six feet deep, and weighs over fifty tons. It was manufactured by the Berlin Iron Bridge Co.

THE record of steam railroad accidents in the United States during September, upon which information could be obtained, includes 139 collisions, 92 derailments, and six other accidents, a total of 237 accidents, in which 65 persons were killed and 198 injured.



SCENE AT CORNER OF MADISON AND STATE STREETS, CHICAGO.

was not over three minutes. It happened right out there," he continued, pointing out of his window, "and the wagon with the men who look after that sort of thing was on the spot at once."

"How about the statement of the newspapers that inadequate accommodations are provided?" was asked.

"This is another instance of gross exaggeration. I have in my hand a sworn statement showing the cars in which persons were standing. It shows that of the total number of cars operated not over one-seventh of them contained passengers who were standing. One count, for example, showed that of 2,200 cars passing around the loop in a day only 315 had standing passengers."

"Can you accommodate all the traffic with the natural increase for the next five years?"

"Why certainly, although we can't provide seats for everyone when there are gathered at a street corner more people than a train will hold."

Now, as to the North Side road. During the last five years the North Side company has increased its system from thirty-five miles to eighty. During that time it has built twenty miles of cable road, and there is a great demand for more. The demands on the lines are enormous, and Mr. Yerkes speaks of the cause in this way:

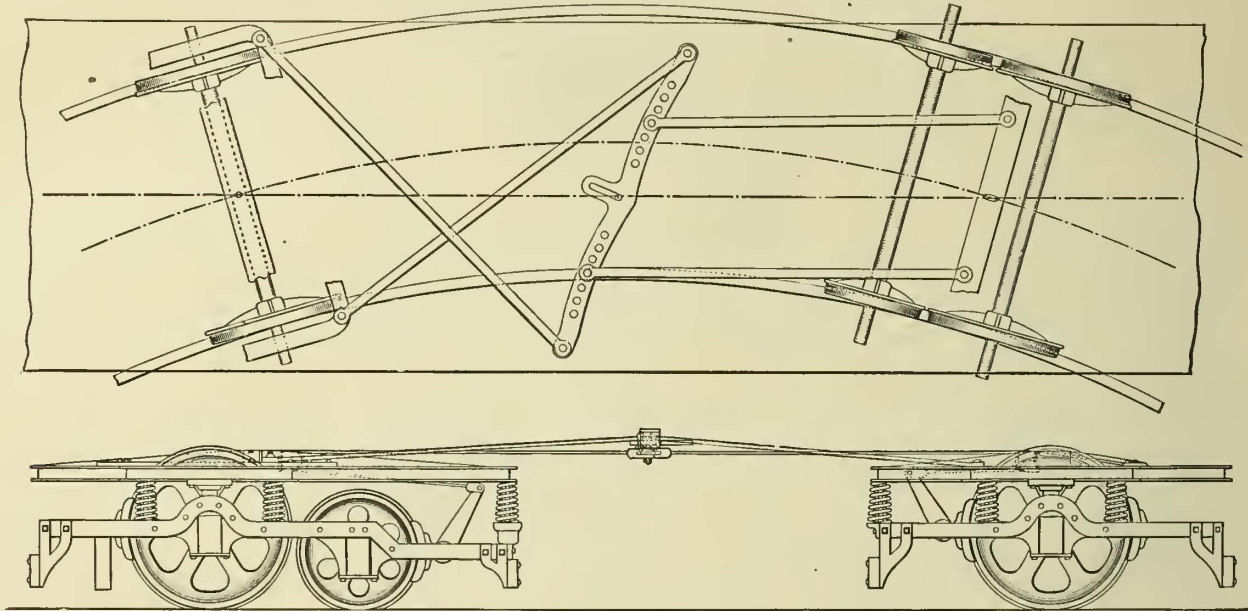
"Here we have a great city growing faster than we can realize. In the heart of the city there are buildings in which 3,000 persons do business. I do not criticize this, but it shows the number of people that congregate in the business centre every day. It is a big business centre which everything pours into and out of in an exceedingly short space of time."

The Shaw Radial Car Truck.

A number of interesting trials have recently been made on the line of the Merrimac Valley Street Railway Co. and other roads in that neighborhood, with a new car truck, the invention of Henry S. Shaw of Boston, Mass. The construction of the truck is simple, as will be seen from the accompanying engravings, which give its plan and elevation. It has two pairs of driving wheels, with one small pair of wheels, which act as guides and which are attached to one set of the driving wheels. The wheels at the forward end of the car follow automatically the line of track whether it be straight or curved, and the

difficulties attending the operation of conduit schemes will be avoided. The company hopes to have the road in operation within ninety days.

The electric railway at Buda-Pesth has attracted an extraordinary amount of attention during the last year, and it has been described as the only successful conduit electric railway in the world. It is not improbable that the success of the road has been somewhat exaggerated, for little has, apparently, been written of the natural difficulties to be expected in the operation of a road of this kind. The owners of the system, Siemens & Halske, have great faith in it and believe it will solve the problem. Mr. Mysenburg, of Chicago, became interested in the road



THE SHAW RADIAL CAR TRUCK.

radial bars by which both sets of wheels are connected give the second pair of wheels the same direction, by means of the movement of the body of the car. The radial bars also hold the wheels in place and aid them in passing over obstruction on the track.

The truck is so arranged that ninety per cent. of the load of the car comes upon the driving wheels, to which, of course, the motors are connected, only ten per cent. of the weight being supported by the small wheels. Further information in regard to the working of this truck can be obtained from Samuel A. Randall, 143 Federal Street, Boston.

Two Underground Electric Railway Projects in Chicago.

Although there are electric railways in Chicago they are located at a considerable distance from the centre of the city. The fact that no electric road has been built nearer the business section is due to the fact that Prof. J. P. Barrett, the city electrician, is an uncompromising opponent of overhead wires. No company contemplating the use of conductors above ground can expect any encouragement from him. The development of a conduit electrical system is therefore of particular interest to Chicago.

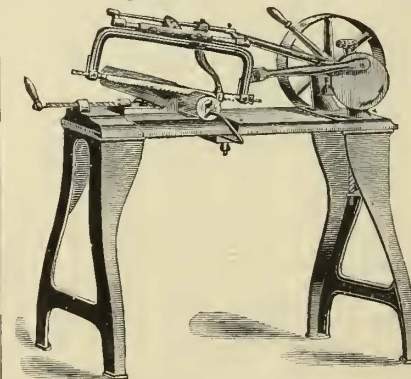
At the present time there is a prospect that a thorough test will be made of two of these systems. It has already been stated that the Fullerton Avenue loop on the North Side will be equipped with the Love system. This section is about a mile and a half in length.

To equip this line with the Love system will involve a heavy expense, but the company which is exploiting it believes that the test will demonstrate the practicability of the plan. The car which will be used will be a small one, only ten feet in length; it will be equipped with an Eickemeyer motor. It will be built, in all probability, by the Pullman company. It is true beyond question that the electrical features of the Love system have been well worked out, and the construction is such that many of

when in Buda-Pesth last summer, and called Mr. Yerkes' attention to it. The latter thought it advisable to make a trial of it in Chicago. The test will be made on one of the West Side roads. General Manager Parsons, of the West Side company, is authority for this statement. It has erroneously been stated that a contract has been awarded to O. W. Mysenburg & Co. for the installation. No contract has been made, but it is not unlikely that the firm will build the road. Mr. Wright, of the firm, left for Buda-Pesth on December 8, to make a thorough study of the system. The matter will probably be definitely settled within two months.

The Star Power Saw.

In street railway power houses and repair shops a power saw for cutting iron and steel bars and pipe often proves a great convenience, if not, in many cases, a positive necessity. To furnish a convenient and inexpensive machine of this character has been the aim of the Millers Falls Co., of Millers Falls, Mass., the saw being shown herewith.



By this machine metal can be cut much more rapidly than by a lathe, planer, or blacksmith's hack. By its use also a good percentage of metal is saved, as the pieces cut are left smooth and no labor or metal is lost in squaring up, as in the case after cutting with the hack.

No attention is required by the machine while in operation until the piece is cut off. The expense of the blades is small, since one blade will cut a steel shaft four and a half inches in diameter several times.

Electric Plant of the Missouri R. R. Co. of St. Louis.

The Missouri Railroad Co. has under its control a cable division, commonly called the Olive Street line, and an electrical division, the Market Street line. The former is one of the best cable roads in the country. For economical working it has very few equals. There are about 200 cars operated by cable power, of which forty-five are grip cars, and of the 155 trailers half are summer and half winter cars. There are in operation at the present time by cable about eleven miles of road extending from Fourth Street on the east to Forest Park on the west.

The electrical division, with which we are more intimately concerned in this article, runs from Fourth Street to Tower Grove Park, a distance of five and a half miles, double track. The cars of the Forest Park, Laclede Avenue & Fourth Street railway use the tracks of the Market Street line from Fourth Street to Twenty-seventh

main line of the Wabash Road runs along the north side of the building, and here the coal cars deliver bituminous coal through the large doors opening into the boiler room. The entire building is square in form, and measures 142×135 ft.

The engine room (see Fig. 2) which occupies the south and east sides of the building, and is in the form of an L, measures 135×106 ft. The present engine equipment consists of one 1,000 H. P. engine of the Hamilton-Corliss type, and built in Dayton, O.; two of 600 H. P. of the Harris-Corliss type, built in Providence, R. I.; one of 100 H. P. built by Porter & Allen, and one of sixty H. P. built by the Fulton Iron Works Co. of St. Louis, an aggregate of 2,360 H. P. This is the ultimate capacity of the plant, as there is no more space left for additional equipment. The cylinder dimensions of the 1,000 H. P. engine are 36×60 ins.; of the two of 600 H. P. each, 30×60 ins.; of the 100 H. P. engine, 12×20 ins.; of the sixty H. P. engine, 10×20 ins. The diameter of the 1,000 H. P. engine's flywheel is twenty-

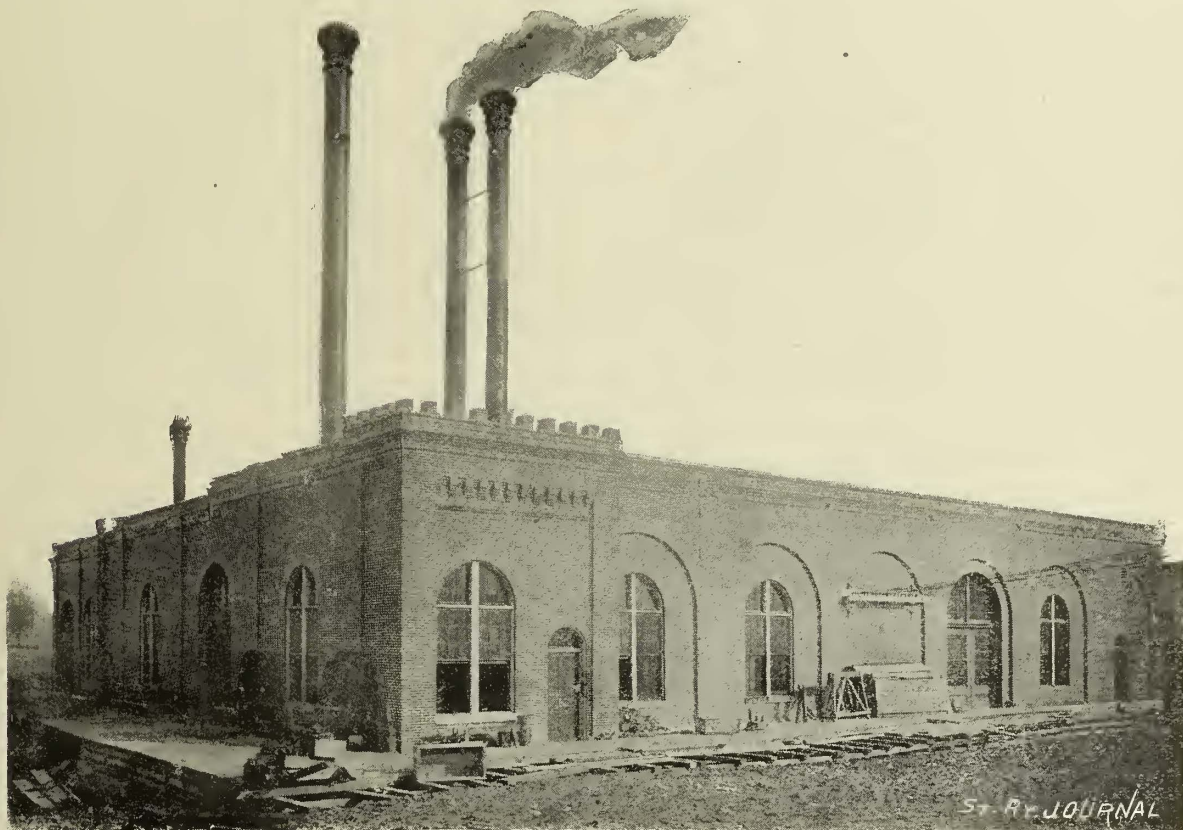


FIG. 1.—EXTERIOR OF POWER STATION, MISSOURI R. R. CO., ST. LOUIS.

street, then branch off to Laclede Avenue, and run along this street to Forest Park, a distance of about one and three-fourths miles. Our reason for mentioning this road is that it is operated by the Missouri company, deriving its power from the latter's power station, housing its cars in the latter's car house, etc. Both lines have been in operation for eleven months, and their performances in handling the traffic have been most satisfactory. They parallel the cable road belonging to the same company, and in consequence have relieved it of some of its passengers, but the receipts of both lines belong to the same stockholders.

The power station (see Fig. 1) is situated on Clayton Road and the Wabash Railroad tracks, and thus its coal facilities are of the very best. No attempt has been made at architectural beauty in putting up this structure, but it was designed to be a substantial building for practical uses, such as all buildings of like nature should be. It is of stock brick laid on a heavy limestone foundation, and is one story in height. The high windows on the south and east sides provide ample light, and are large enough to do away with the necessity of any extensive skylight arrangements. Sufficient ground lies between Clayton Road and the structure itself for a large addition, should any such ever be needed. A switch from the

eight feet, face six feet three inches, weight sixty-eight tons; of 600 H. P. engine's, twenty feet, fifty-four inches, twenty tons, respectively, diameter of 100 H. P. engine's flywheel five feet six inches, face fifteen inches; same of sixty H. P. engine, seven feet eight inches. All engine bearings are equipped with self oilers; and all engines are so arranged that they are in communication with the shafting and pulleys. The latter are arranged in one long line, 120 ft. in length. The shafting is divided into two sections, one of which has a diameter of eight inches and the other of nine inches. The latter half has recently been put in, and it is to be operated in connection with the 1,000 H. P. Hamilton-Corliss engine. All the pulleys are provided with the Hill clutch device, made by the Hill Clutch Works of Cleveland, O., and thus the direct coupling of the engines and dynamos is not permanent, but they may be interchanged at will. All shafting bearings are supplied with self oilers, and a speed of 182 revolutions per minute is maintained.

The required tension on the belts is regulated by means of the dog and screw arrangement made by the Hill Clutch Works. This not only tightens or loosens the belt, but gives to it a certain side or lateral play, which greatly increases its efficiency. The belts are all solid and were made by the Charles Munson Belting Co. of

Chicago. The width of the belt used with the 1,000 H. P. engine is seventy-two inches; with the 600 H. P. engines, fifty-three inches; with that of 100 H. P., thirty-five inches; with the sixty H. P. engine, sixteen inches.

The boiler room is 100x36 ft., and is at present equipped with six boilers, in batteries of three each. The boilers are of the ordinary tubular type, and were made by Rohan Bros., of St. Louis. They have a six inch shell, are twenty-two feet in length, and have a diameter of sixty inches. Each boiler has eighteen flues of six inches diameter each. One battery is used at a time, but as soon as the 1,000 H. P. engine is put into operation an additional battery will no doubt be required. The boilers are supplied with water from the city mains. There are two Hooker No. 10 pumps in use, manufactured by the Hooker Co. of St. Louis, and a vertical pump of the type that steamboat men call a "doctor." A Rohan heater,

they can be self or separately exciting, a small exciter being operated by the sixty H. P. engine. Each generator is equipped with the latest type of Thomson-Houston lightning arrester, and the automatic circuit breaker of the same company.

The switchboard is very neatly fitted up in cherry. There are fourteen feed wires centering at the board, and each one is marked with the name of the street at which it connects with the trolley wire. The switches are insulated from the switchboard by means of square slate slabs, while in the case of the resistance coils, rheostats etc., the insulating material employed is porcelain. Very much to the credit of the Thomson-Houston company and the scrupulous care of the railway company's electrical engineer, but one generator has been taken apart since the road started operations eleven months ago, and this machine, which is one of those first installed, is apart at

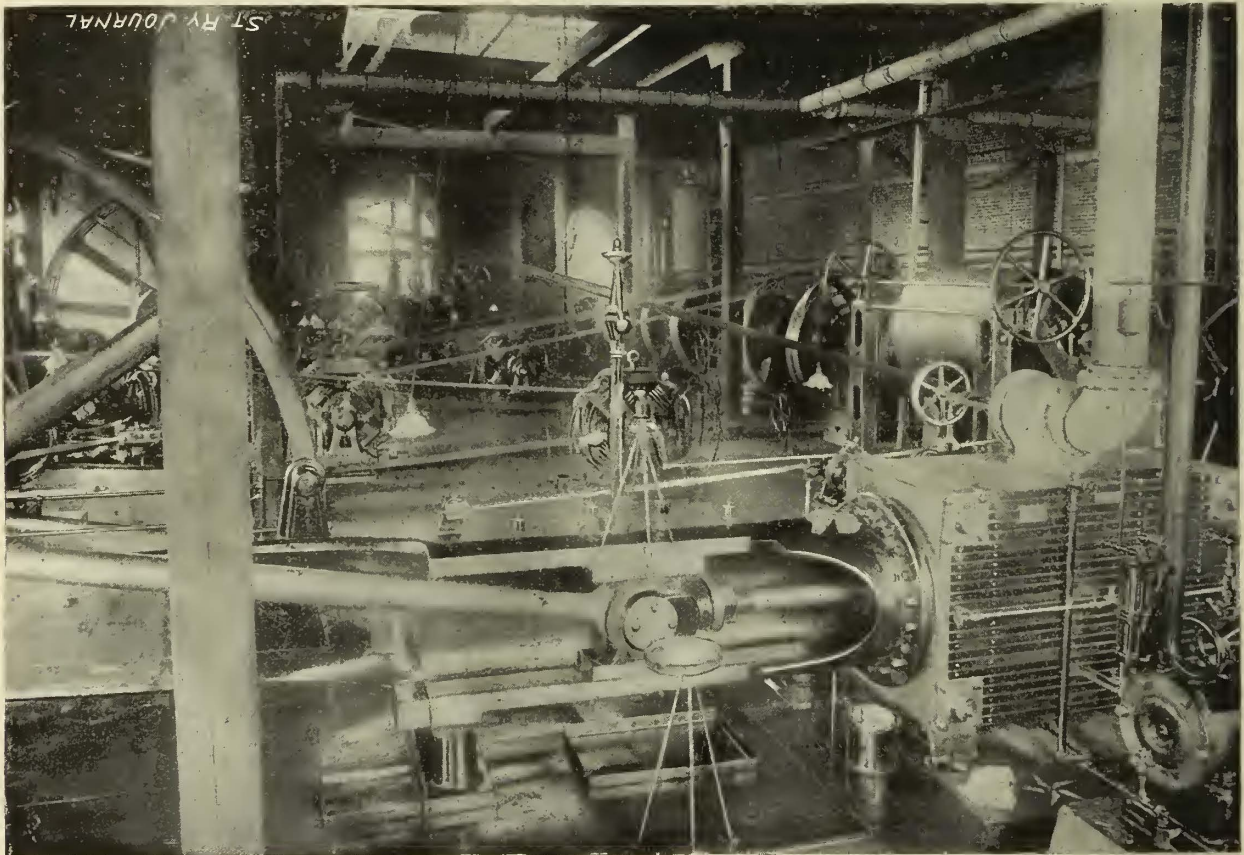


FIG. 2.—INTERIOR OF POWER STATION, MISSOURI R. R. CO., ST. LOUIS.

is used to heat the water to the required temperature, 212 degs., before its entrance into the boilers. Combined with the heater is a patent settler for clearing the water of all mud and impurities.

The steam piping outfit is about as complete as it could be. The main steam pipe runs from the boiler room to the north side of the engine room. It is here divided, one part branching off towards the 1,000 H. P. engine, and the other towards the four other engines. All pipes are covered with a good thickness of asbestos bound to them by means of brass strips.

There are at present in use three steel smokestacks. (See Fig. 1.) They are ninety-five feet in height, and have a diameter of forty-four inches. They are given a good appearance by a capping of ornamental flutings. The steam engineering was done by Rohan Bros., and the Kupperle Co., both of St. Louis, and a great deal of credit is due them for the admirable manner in which they have equipped the plant.

The generator equipment consists of seven Thomson-Houston machines. Two of these are of the "M. P. 250" four pole type, of 275 H. P. each, and make 400 revolutions per minute. The five smaller dynamos are also of the multipolar type, of 100 H. P. each, and make 750 revolutions per minute. All the machines are so arranged that

the present time, simply for renewing the binding strips on the armature.

There are in operation at the present time thirty motor cars and fifteen trailers, one half on the Market Street line and one half on the LaClede Avenue line. All the rolling stock was built by the J. G. Brill Co., of Philadelphia, and is representative of the fine work turned out by that company. The car bodies are sixteen feet long, while the length over all is twenty-four feet. The trailers are of the same dimensions as the motor cars, are equipped with Brill's patent equalizing gear and two of Smith's patent double centre lamps. The motor cars are lighted by electricity, and are equipped with Brill's patent No. 7, independent, rigid motor truck. On each truck are mounted two fifteen H. P. Thomson-Houston double reduction motors. Comment on the workings of the motors is almost unnecessary, as motors of this class have already established an enviable reputation for themselves. A thirty inch wheel is used with the motors, while the trailers are equipped with wheels of twenty-two inches diameter, and thus afford greater convenience for passengers boarding the cars. The cars are run at an average speed of ten miles an hour. This means about eight miles an hour downtown, and twelve miles an hour in the outlying districts.

The track construction is the very best that could be desired. From Fourth Street to Twelfth Street the stringer construction, laid while the road was operated by horses, is still in use and is quite as smooth as the girder construction. The wooden stringers seem to act very much like a cushion. This is most noticeable when the transition from the stringer to the girder construction takes place, the latter having a smooth but hard sensation. The remainder of the road, from Twelfth Street to Forest Park, the terminus of the Laclede Avenue line, and to Tower Grove Park, the terminus of the Market Street line, is laid with seventy-eight pound Johnson girder rail. This portion of the road, especially where the street is paved, is most substantial. The ties are planed squares and placed quite as near together as in steam railroad construction. Concrete, well tamped, serves to make the road as rigid as possible, and all joints are well guarded by an additional tie. There are no suspended joints, but each joint is supported by a chair and the latter by a tie. All curves, where the street is not paved, are laid with orange wood blocks, and where the Market Street line crosses the Missouri Pacific and St. Louis & San Francisco tracks smooth but heavy crossings are provided for both steam and electric cars.

The company's car house is situated at Compton Avenue and Dexter Street. It consists of one large building a block in length. One end is but one story in height, and here are accommodations for the Laclede Avenue cars, and at the other end, of the same height and dimensions, are accommodations for the Market Street cars. The centre of the building is of two stories, and here are situated the general offices as well as the car repair shops of the company.

At the Forest Park terminus of the Laclede Avenue line the management intends erecting an extensive pavilion to accommodate next summer's crowds.

In conclusion, we wish to thank Mr. P. C. Maffit, President of the Missouri Railroad Co., Mr. Hill and Mr. Thompson, respectively, steam and electrical engineers of the power plant, for their courtesy in giving us the above information.

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The Practical Side of the Electric Railway.

Chapter II.—Overhead Construction.

By J. H. BICKFORD.

There are two methods of line construction, known as the direct and indirect. The term "direct" is applied to that method of construction in which the trolley wire or working conductor is of large area and of high conductivity and carries the current its entire length, being connected only at one or two points with the feed wires which lead out direct from the station.

The second or "indirect" method is that in which the trolley wire or working conductor is of smaller area and of low conductivity, and is divided into sections of 500 or 600 ft., each of which is connected to a parallel wire of high conductivity, called a main, which is run on the poles at the side of the street, and which is fed at intervals, so that the current is maintained at a nearly uniform potential throughout the entire line.

The first method has some advantages over the second on short lines two miles or less in length and on which only a few cars are operated. In this case the No. 0 copper wire which is usually used is of sufficient capacity to carry the current, but on long roads where it becomes necessary to reinforce the working conductor by feed wires the large wire has no advantage, and being heavy entails an additional expense for maintaining it above the street. On long roads where the direct method is employed the potential at the points most distant from the station is usually very low; not more than 300 volts on a certain five mile road with which I am acquainted, this condition being due to the absence of feed wires.

Some of the disadvantages attending the use of a heavy 0 wire where it is possible to reinforce it, are that it requires very large poles to support it in order to keep

it in proper position; it is unwieldy and difficult to splice, and if made of copper has a low tensile strength compared with wires of other material; being soft it wears more readily and offers a large surface for the accumulation of snow and sleet; from its tendency to stretch it is difficult to maintain it in position on curves or hold it to a proper adjustment on the tangents.

From the above it will be seen that hard drawn copper wire has few advantages to recommend its use on either long or short roads. On the other hand, the indirect method has many advantages and possesses few of the disadvantages of the direct method either on short or long roads. The working conductor employed with the indirect method is usually a No. 4 silicon bronze wire which is extremely light in comparison with copper wire of the same size and has a greater tensile strength; it is easily handled, will not stretch perceptibly, and has far better wearing qualities; its greater tensile strength ensures it from accidental breaking, and its small area offers little surface for the accumulation of sleet and snow; it is easily held in position on curves and can be readily spliced. Another great advantage attending the use of small wire is the fact that being light the trolley wheel in passing tends to lift it, causing it to bend at every point, which, in case it is covered with snow or sleet, tends to crack the incrustation so that it falls off in showers as the wheels roll along, while the large wire being virtually a rod is not raised perceptibly by the trolley, and in case it is covered with sleet the wheel is liable to pass over it without making a contact. It is not claimed that with the smaller wire the trolley will clear it of snow and ice in all cases, for it sometimes becomes so thick that it is necessary to clear it off with poles and scrapers. But in any event it can be removed from the smaller wire more readily than from the larger one.

I am confident, from personal observation, that most of the electric roads that have been built within three years will necessarily be reconstructed within five years from the date of building, many having already been reconstructed. Of course, the fact must be recognized that the business being new, many blunders were made from inexperience; all had gradually to feel their way up to a proper standard, and it is not surprising that cheap work and cheap material played an important part in early constructions. The question has been heretofore not how good but how cheaply can a mile of electric road be built. Will it cost over \$1,200 or \$1,500 per mile? Had the answer been "Yes, it will cost twice that amount for a good line," many roads would have more dollars in their treasury to-day than they now have. In order to make the construction inexpensive, small poles were employed, and in many cases were not set more than four feet in the ground. In fact, some recently constructed lines have made the blunder of setting their poles with too short a section underground. Poles that are small and insecurely set will bend and cut their way through the soil and will soon appear to have a decided attraction for the other across the street, while the trolley wire shows a like attraction for the rails. Although thousands of wooden poles have been employed that are not more than eight inches in diameter at the ground line and four or five inches at the top, we do not hesitate to say that it is a waste of money to follow such a practice, as such poles will not hold the wire in position more than three years. With their use span wire cannot be kept taut, and if the trolley wire is particularly heavy the sag will be correspondingly great, and when the attempt is made to take up the sag such poles will either break or bend, depending on the wood, whether chestnut or cedar.

Where cedar poles are employed they should not be less than thirty feet in length nor less than eleven inches in diameter at the ground line and not less than eight inches at the top. Chestnut poles should be of the same length and not less than ten inches at the ground line and seven inches at the top. Where round steel poles are employed the sections of tubing should not be less than six inches, five inches and four inches. The six inch section should be about eighteen feet long, the five inch

section about eight feet and the four inch section four feet; this will make a total length of thirty feet. We are aware that most steel poles are made from twenty-six feet to twenty-eight feet in length, but this not enough. If guard wires are to be employed thirty feet is the least length that ought to be employed, and where feed wires are employed the poles should even be higher than thirty feet. It is not a good practice to attach a number of feeds to a short slim pole, and a thirty foot pole should not be required to carry more than a two pin arm. Wooden poles of the dimensions above named, except as to length, are large enough for streets of ordinary width, but steel poles of the above dimensions should be confined to streets not exceeding fifty feet in width. On the curves where heavy strains occur larger poles, whether of wood or metal, should be employed in order to maintain the trolley wire at the required height.

In case wooden poles are to be employed I would recommend a hard pine pole not less than ten inches square at the base and tapered to not less than eight inches at the top. The first twelve feet at the base should be left square and the remaining length sawed octagonal. The poles should be set not less than six feet in the ground, and after setting, the corners, from twelve inches above the ground up, may be chamfered leaving the surface one inch wide. This will make a strong, neat pole that will cost about six dollars. The top should be coned, and painted to prevent decay from the effect of moisture. The pole being in position, a piece of timber or plank should be placed next the curb about fifteen inches below the surface of the ground and stones should be tamped in at the back of the pole near its foot. Steel poles should in all cases be set in a concrete foundation, and it is also better to set wooden poles in the same material. Wooden poles should be set to rake away from the street at least twenty-four inches as they will pull up straight in time and will look much better looking outward than inward. Poles with brackets, however, may be set straight or nearly so. Both wooden, and steel poles should be painted with some neutral color except at the base which may be in some dark colors.

(To be continued.)

Foreign Street Railway Notes.

By Our Special Correspondent.

STREET RAILWAYS IN HOLLAND.

During the last few years the system of street railways in Holland has developed upon a remarkable scale. This may be caused by the Dutch laws which contain very favorable stipulations for the construction and working of street railways. The gauges employed are various, 2 ft. 5½ ins., 3 ft. 3½ ins., 3 ft. 6 ins., 4 ft. 8½ ins. being the most common. The track construction is of many different patterns, but after ten years' experience the Vignol rail on timber or steel ties, has been adopted generally, except at cross streets where grooved rails on stringers are still used. The lines are almost always of single track and have no special stopping stations.

In the towns the street railways are operated mostly by horses, but in the country, nearly without exception, by locomotives. If the locomotives are used inside the towns all the moving parts of the machinery are covered by an iron case and they are also furnished with a smoke consumer. In several towns and villages a law is in force that in narrow streets a man with a bell must go before the train; this is made necessary because the train passes sometimes very close to the houses of the street; there are, in fact, places where the space between the train and the house is only four inches. On several lines only one man is employed on the locomotive; but in most of the provinces of the kingdom the authorities have ordered that two men, viz., an engineer and a fireman, must be on each locomotive.

Since the first of January, 1890, the highest allowable speed has been fixed at twelve and a half miles per hour; but while passing through towns and villages and while

crossing bridges and important roads in many provinces only 4.6 miles per hour are allowed by provincial law.

In many cities in Holland a special tax is levied per car for the use of the streets. As a short car pays the same tax as a long car, the street railway companies prefer to use the latter. In consequence, a train is composed very often of the locomotive, baggage car and one passenger car containing first and second class compartments with thirty-six seats inside and room for sixteen passengers on the platforms.

In the year 1890 there were forty-seven companies operating 556 miles of street railways in Holland. Of these 522 miles were of double track and thirty-four miles of single track. Thirteen companies used only horse power and twenty-nine companies only steam power, while five companies used both steam and horse power. Of the above mileage one-half was of the standard 4 ft. 8½ ins. gauge. There were owned by these companies 213 locomotive engines, 1,023 horses, 802 passenger cars and 467 baggage cars.

UNDERGROUND RAILWAYS IN GLASGOW.

The construction of an underground railway in the important city of Glasgow was approved by Parliament in the year 1888, but the contracts for the different portions of the work have only recently been let.

This railway will cross the city of Glasgow from the east to the west and will have a total length of about six and a half miles. It starts from a branch line of the Caledonian Railway in the south-east part of the city close to the north bank of the river Clyde, then crosses the oldest city park of Glasgow, going along a nearly straight series of streets to the Queen's Dock, with which railway lines it will be joined by sidings. From the Queen's Dock it turns to the north and goes through a hill on which the West End park is situated, crosses the Kelvin River and the Botanical garden and comes out on the open ground where an extension may ultimately be made.

The greater part of the line will be entirely underground, but at several points the road will be carried in open cuttings whose sides will be secured by retaining walls. The track will lie, on an average, twenty feet below the surface of the streets.

At each of the thirteen stations proposed the ticket offices will be placed on the street level and staircases will lead to the railway platforms. The steepest gradient on the line will be one in eighty.

The total cost of this railway is estimated at £4,700,000 out of which £220,000 must be paid for real estate.

ELEVATED RAILROADS IN BERLIN.

The well-known electrical firm of Siemens & Halske in Berlin has prepared plans for the construction of a network of elevated railroads in the city of Berlin which will use electricity as a motive power. All cars will be equipped with motors and will be run separately under a headway of from two to three minutes. In cases, however, of great traffic, trains are to be formed of two to four of these motor cars. A service of eighteen hours a day is proposed. It has been estimated that each car on each run between the terminal points of the line will carry forty passengers, and that 15,000,000 to 75,000,000 passengers will be carried in each year.

The cost for constructing these elevated railroads of double track has been calculated to be \$605,000 per mile. Taking this figure as a basis the total cost of the proposed elevated railways will be \$22,000,000. The present plan is to construct only the south line of only five and a half miles in length, provided, of course, that governmental sanction can be obtained, which is considered doubtful.

ELECTRICAL STREET RAILWAYS IN RUSSIA.

The first electrical street railway in Russia will be constructed in Kiew, a city of about 130,000 inhabitants and situated on the river Dnieper. This street railway will use the overhead system and will be ready for operation in the summer of 1892.

Conditions of Maximum Motor Efficiency.

An interesting paper entitled "A Motor Operating Automatically at any Desired Speed or Torque, and with Maximum Efficiency Under all Conditions," was recently published by H. Ward Leonard. An abstract of the article together with a reply by C. O. Mailloux, published in the *Electrical Engineer* is given below :

MR. LEONARD'S PAPER.

In the operation of electric motors there are three principal factors to be considered, the speed, the torque and the efficiency. Under any variations in power the efficiency should remain as nearly constant as possible. For one class of work it is desirable to keep the speed constant when the torque varies. For a second class of work it is desirable to keep the torque constant at one particular amount when the speed varies. For a third class it is desirable to operate at many different speeds, and yet automatically at any particular speed desired regardless of the torque. For a fourth class it is desirable to operate at many different torques, and yet automatically at any desired torque regardless of the speed; and for a fifth kind it is desirable to keep the amount of power supplied constant, regardless of a change in torque, that is, so that if the torque changes by the requirements of practice, the speed would automatically change so that the power consumed would remain constant.

Of the above five principal classes of work there is only one, namely, constant speed and variable torque, which we can take care of with reasonable efficiency and from our existing supply circuits.

It is well known that when a street car is first started and is scarcely in motion the actual power represented by such motion is almost nothing, for, although the pounds pull is large, the feet per minute is extremely small; consequently the power required must be exceedingly small. What do we find in practice? We find that in order to develop a power of but a fraction of a horsepower we must, on account of the slow speed demanded, develop about 30 H. P., and then waste about ninety-eight per cent. of this horse power in order to utilize the remaining two per cent. in the way it is desired. The efficiency of the modern electric street car is not probably more than two per cent. when just starting from dead rest and moving at the rate of one-half foot per second.

When we come to investigate this, we find that the explanation is that in order to get the necessary large torque with freedom from excessive sparking we must have a very large current in a nearly constant field; and since our E. M. F. is constant we must use an amount of power which will vary almost directly with the torque, and will be regardless of the speed. Or, in other words, the efficiency of the motor will vary directly as the speed, with an efficiency of perhaps eighty per cent. at full speed.

As a result of my investigation of this subject I have concluded that the operation of electric motors should conform to what apparently, is a new law and which may be stated as follows :

Vary the voltage as the speed desired.

Vary the amperes as the torque required.

In other words, make the speed dependent upon the voltage only and independent of the current, and make the torque dependent upon the current only, and independent of the voltage. Since the product of the speed and torque represents the work being done, and the product of the volts and amperes represents the power supplied, it is evident that if we can operate in conformity to this law, we shall have a constant efficiency under all conditions, disregarding, of course, the small fixed losses in the field and armature.

One way in which this law can be followed is to supply the field of the motor from one source of electric energy and supply the armature from another source, the E. M. F. of which can be varied. It will be noticed that when the speed is fixed a fixed voltage will be necessary in order to conform to the law, and the shunt motor is found to conform perfectly to the law; but it is the only motor I know of which does conform to the law which seems to be generally applicable.

For operating an electric railway we will place a shunt wound motor on the car, and directly driven by this motor will be a special generator, which will be connected to the electric motor below the car. It is evident that the generator and working motor armatures may be wound for any voltage desired, say 20 volts, which will make the problem of insulating the street car motor an extremely simple one. If desirable, we can supply several cars of a common train from one special generator on the forward car. With this outfit we will be able to take any car up any practicable grade or around any curve with no more power than is required to move the car on a level, and always consume the same power, regardless of weight, grades or curves. That is, the automatic increase of current, to take care of any increased torque, will be compensated for by a corresponding decrease in the volts and speed.

I wish to call attention to a very important development leading out from this, namely, that we will be able to use alternating currents for operating our street cars, for it is well known that the ordinary alternating current generators will operate perfectly as motors, if the speed and torque be kept constant. Since by this system we can, from a constant torque and speed, get any other torque and, automatically, a corresponding speed, we shall be able to run street cars perfectly by alternating currents. This again will enable us to dispense with trolleys, conduits, storage batteries, etc. We will place between our tracks, in manholes, converters whose primary pressure can be anything required for proper economy and whose secondary will be, say, fifteen volts. This secondary circuit will connect directly with the rails. The road will be divided in sections, each a few hundred feet long, and each section will be supplied by its own converter,

On first consideration, the additional apparatus necessary would seem to make the system prohibitory in practice; but the capacity of the present single motor is greater than the combined capacity of the apparatus this system would require, and the capacity of the prime motor is very much reduced.

In order to reduce the first cost to a minimum and yet secure the advantages of different automatic speeds and high efficiency, I have devised two modifications of the arrangement described above. The first is adapted to power in which a smooth, efficient acceleration of a load from rest is required, as in the case of passenger locomotives and elevators. The second case is where various automatic speeds are desired, but no especial importance attaches to the starting of the load from rest, as is the case in machinery in general.

For the first case we have the trolley system of electric street cars as the most important. Let us suppose we have two motors of 15 H. P. each for the car. We find that for full speed upon a level we require about fifteen amperes at 500 volts. Upon heavy grades we find that about fifty amperes are required, and, as before, we have 500 volts. With this consumption of energy we find that we get a speed upon the heavy grade which is about one-quarter of the speed upon a level. In order to operate upon my system let us place upon the car a motor generator, the motor part of which is wound for 500 volts and twelve and a half amperes, and the generator part of which is wound for 125 volts and fifty amperes. The fields of the motor and generator part are distinct and are wound for 500 volts, as are the fields of the two propelling motors under the car. All these fields are supplied from the 500 volt trolley circuit. In the field of the auxiliary generator is placed a rheostat.

Now, suppose the car rests upon a grade. The motor generator is running, but the generator has a very weak field. Its armature is connected by a controlling switch to the propelling motors. We now gradually cut resistance from the generator field circuit and finally get about twenty volts at the brushes of the generator. With this E. M. F. we get sufficient current to produce fifty amperes through the armatures of the propelling motors in a saturated field. This gives us the full torque and the car starts at a speed of perhaps half a foot a second. This speed can be maintained constantly and indefinitely, and the consumption of energy will be less than two H. P. This is less than three amperes from the trolley line. In practice, however, the speed will be rapidly but gradually accelerated until we have 125 volts upon the terminals of the propelling motors. We will now be running at one-quarter speed and will be consuming 125 volts and fifty amperes, that is, $6\frac{1}{4}$ K. W. instead of 25 K. W. to get the same result with existing motors. To put it another way, we will not be using as much energy as is represented by the 500 volts and 15 amperes necessary for full speed on a level.

The next step on the controlling switch will disconnect the armatures of the propelling motors from the auxiliary generator and put the two armatures in series across the trolley line direct. We will now go at a speed represented by 250 volts, that is, one-half full speed. The next step of our switch will place the two armatures in multiple across the 500 volts, and the next and last step will place the 120 volt auxiliary generator in series with the main central station generators and give us 625 volts on our armatures and a correspondingly increased speed. We will be able to go up a grade of six to eight per cent. at full speed, with fifty amperes and 500 volts, which, with the present motors, gives us only about one-quarter of that speed.

Under this arrangement it will be noticed that the only apparatus which could be called additional is the small motor of 500 volts for the generator part of our motor generator, which is useful not only for starting, but for full speed also. In stopping the car we have an electric brake action delivering back energy to the line at full efficiency and not through a rheostat, as at present.

If we have a train of, say, three cars, so that we have six motors, we can start from rest with sufficient smoothness by placing all six armatures in series, which will give us something less than one-sixth speed as the first step. Then we can place three in series with two multiples, which gives us one-third speed. Next, two in series with three multiples, which gives us one-half speed; and finally, all in multiple, which gives us full speed. Under such conditions, we can dispense with the small converting plant altogether.

THE LAW OF MAXIMUM EFFICIENCY OF ELECTRIC MOTORS.

BY C. O. MAILLOUX.

In the very interesting article on his new method of operating motors, Mr. H. Ward Leonard enunciates a so-called new law of efficiency which is, unfortunately, not free from objections.

Mr. Leonard states his "law" as follows :

"Vary the voltage as the speed desired,"

"Vary the amperes as the torque required."

The now classical researches and historic experiments of Marcel Deprez have long since consecrated these two statements, which are to be found, more or less amplified and elaborated, in the writings of Du Moncel, Froelich, Ayrton and Perry, Silvanus Thompson and others. The claim to novelty rests upon the "combination," or rather, the opposition of the two statements to make a law. It so happens, however, that the combination does not formulate a law, but merely states, somewhat awkwardly, some of the conditions favorably to the law—Siemens' law of efficiency. The awkwardness and vagueness of diction is made readily apparent by the fact that a good illustration of the "law," as worded, obtains in the now common practice of regulating street car motors by means of a variable resistance in the circuit. The manipulation of this resistance at the time of starting, or afterwards, causes the amperes to vary as the torque required. It also causes the voltage (available at motor terminals) to be varied as the speed desired,

The trustees have received for this purpose up to this time,

From the City of Brooklyn.....	\$360,000.00
From the City of New York.....	180,000.00
	\$540,000.00

The Act of 1891 provides that the funds to meet the cost of the improvement shall be secured by the comptrollers of the two cities, borrowing upon the respective credit of each city the proportion therein required to be paid. It further provides that the bonds to be issued for such loans shall be thirty year bonds, and shall bear interest at three per cent. and shall not be sold at less than par. This Act was passed at a time when, in the light of previous experience, it was assumed that such bonds could be readily disposed of. Upon attempting to market the bonds as directed by the Act, the comptroller of Brooklyn found the condition of the money market to be such that only 360 of the bonds could be sold. The trustees are advised that the financial condition of the community is such that money-seeking investment can find in it more profitable channels than municipal bonds paying three per cent. interest, and that so long as this condition of the business community continues, it will be practically impossible not only to complete the work on the Washington Street improvement, but to make progress upon any other portion of the improvements authorized by the legislature.

These facts necessitate the early application for legislative amendment of Chapter 128 of the Laws of 1891, either by the removal of the restriction requiring the bonds to be sold at par or by providing that the moneys necessary for the carrying on and completion of the work, shall be raised by the sale of bonds bearing a larger rate of interest than that prescribed in the Act under consideration.

In anticipation of the acquiring of the land the trustees directed detailed plans for the necessary structures provided for in the adopted plans to be prepared, and when prepared, ordered the necessary steel and other material for the building of such structures. All of which had to be made especially for this work.

This rendered it necessary for the contractors to commence its production as soon as the order was placed, with the result that the entire material is now in the hands of the contractors ready for delivery, but the trustees are unable to accept it for lack of funds. This presents the complication that for such material the trustees may have to pay not only the contract price, but at least interest upon the deferred payment by way of damages for their inability to perform their part of the contract, by accepting and paying for the material ordered by them, and which was ready at the time provided in their contract.

Travel during the year, over the Bridge railway, has continued to increase, but at a diminished ratio as compared with that of previous years. Up to January 18 the ratio increased; from then to September 27 it diminished; since it has rapidly increased. In the aggregate, however, for the whole year, the increase has been marked. In October last 3,623,016 passengers were carried, an average per day of 120,767, a number greater than that carried during any other month since the railway was first operated; the nearest being in October, 1890, when 3,431,503 passengers were carried, an average per day of 110,694. On November 21 151,554 passengers were carried, the greatest number on any day during the year. On that day 522 trains were run and 1,913 single car round trips were made.

From the opening of the Bridge railway, September 24, 1883, to November 30, 1891, inclusive, 220,487,283 passengers were carried. During the year the trains have run with great regularity and few interruptions. The total time lost by delays from all causes was seven hours and thirty-six and a half minutes, an average of one minute and sixteen seconds per day of twenty-four hours, or of one minute for each 87,111 passengers carried. Of these delays during the year, fifty-four per cent. was occasioned by a failure of or a defect in some of the several parts of the cable hauling machinery, and the remainder, forty-six per cent., by causes common to ordinary railroad transportation.

Contrary to what appears to be a general impression, but little time is lost on the railway in consequence of the grip mechanism failing to act; thus during the past year from this cause there were in all thirty delays, amounting altogether to two hours and fifty-seven and a half minutes, of the 7,300 hours the cable was run.

The previous excellent record of the railway, as being pre-eminently a safe one for passengers, remains unimpaired. Of the large number carried since its opening to public use no one has been killed, and during the past year none have been seriously injured. The principal accidents to trains have been in the form of rear collisions at the stations, caused by an incoming train bringing up against a preceding one, not hauled out from the platform. As the passenger cars are now constructed, when such an accident occurs there is little or no damage done to the cars themselves; and the passengers are entirely safe from shock, as well as from injury, if they are within the cars and seated.

To effectually provide against the possibility of a train, from any remote cause, becoming uncontrollable when going down or up the steep slopes of the Bridge, each car is equipped with two independent brake systems, one operated by air and the other by hand; and in no instance have both of these systems failed to act in an emergency.

For the better accommodation of the increasing number of passengers transported on the railway during the evening and early morning hours, trains are now run from 7 o'clock P. M. to 12.40 o'clock A. M. on three minutes' headway, and from 12.40 o'clock A. M. to 2.40 o'clock A. M. on seven and a half minutes' headway instead of on four minutes' and fifteen minutes' headway respectively, as was formerly.

In the eight years and more the railway has been operated, six hauling cables have been used. Of these, four have been worn so greatly as to necessitate their removal, and two are now in service, one being employed to haul the trains, and the other being held in reserve, change being made from one to the other, as may be required by the

conditions of use. The record of cable service up to November 1, 1891, is given in the following table which exhibits a term and amount of work done by each cable, unparalleled on ordinary cable railways.

CABLE SERVICE ON THE NEW YORK AND BROOKLYN BRIDGE RAILWAY FROM SEPTEMBER 24, 1883, TO NOVEMBER 1, 1891.

CABLE.	CONDITION.	TERM OF SERVICE.		MILES HAULED.	TON MILES HAULED.	AVERAGE NO. OF TONS HAULED.
		DAYS.	YEARS.			
No. 1.....	Worn out.	1140	3.123	228,320	22,142,706	97.
" 2.....	" "	607	1.636	120,232	25,492,892	212.03
" 3.....	" "	393	1.077	82,099	20,395,073	248.42
" 4.....	" "	356½	0.977	74,111	18,923,467	255.3
" 5.....	In use.	276½	0.758	58,581	16,740,912	284.1
" 6.....	" "	187	0.512	39,980	12,506,413	312.8

It will be noticed that though the term of service has decreased from the first to the last cable used, the average load hauled has similarly greatly increased.

It has not been possible during the past year to greatly increase the facilities of the Bridge railway, or to materially lessen the discomforts of travel during the hours when the largest number of passengers are transported. The station platforms and the trains in service are still unduly crowded when the travel is greatest, and relief can only be had by enlarging and improving the termini, and by adding to the capacity of the railway. As elsewhere stated in this report, adequate measures to effect these improvements and to substantially double the capacity of the railway have been taken and are being prosecuted with energy as far as existing circumstances permit.

Toward these ends contracts have been made for the material and erection of the extension of the roadways in New York, and of the railway platform in Brooklyn, for duplicate boilers and cable hauling machinery, and for the roofs and other metal parts required for the extensions of the power and boiler houses. A part of this work in New York is in place; the walls for these houses and the foundations for the machinery are now being erected and will be completed in a brief time. Also to permit the erection of the new station in Brooklyn, on the site along Washington Street, between Sands and High Streets, determined by the Board of Experts, the repair shops have been removed to the new buildings recently erected therefor on the block between High and Nassau Streets.

The proposed addition to the cable driving plant will allow four cables to be placed on the railway, of which two at all times will be ready for use—and the machinery in all its parts will be in duplicate—whereby in case of the failure of any of these parts when in operation, other similar parts held in reserve may instead be immediately put into service. To complete the plans for doubling the capacity of the railway, duplicate tracks are to be laid the entire length of the line and quadruple tracks in the new stations, so that during the busy hours and at other times when the traffic demands it, two cables, one for each track, may be operated.

Respectfully submitted,
ALFRED WAGSTAFF,
President.

Comparative Operating Expenses.

Through the kindness of S. W. Divine, general manager of the Chattanooga Electric Railway, we are permitted to give the following report made by the superintendent regarding the operation of the line for the month of September, and follow it with the report of the West End company of Boston for the month of August. The difference in the operating expenses per car mile will be noted. It must be borne in mind, however, that the latter line employs long eight and six wheel cars.

OPERATIONS OF THE WEST END STREET RAILWAY CO. OF BOSTON FOR THE MONTH OF AUGUST, 1891

Gross receipts.....	\$136,246.00
Motive power.....	25,630.00
Motive power per mile.....	.0704
Total expenses per mile.....	.2069
Earnings per mile run.....	.3745
Net earned per mile.....	.1676

OPERATIONS OF THE CHATTANOOGA ELECTRIC RAILWAY FOR THE MONTH OF SEPTEMBER, 1891.

Gross receipts.....	\$10,375.00
Total operating expenses.....	4,200.00
Miles run.....	79,000
Motive power per mile.....	.0120
Total expense " ".....	.0625
Total earnings " ".....	.1365
Net earnings, " ".....	.0740
Number of cars.....	18.
Number of miles per car per day.....	140
Average income per day per car.....	\$19.06
Total expenses.....	8.00

Report of the Massachusetts Street Railway Company.

The following figures are taken from the annual returns of several of the largest street railway companies in Massachusetts to the railroad commissioners of the State. The period covered is the year ended September 30, 1891:

West End Street Railway.

	1891.	1890.
Capital stock authorized by charter.....	\$16,400,000	\$11,900,000
Capital stock authorized by vote.....	16,400,000	11,900,000
Capital stock paid in.....	13,549,350	9,891,150
Funded debt.....	4,272,000	4,034,442
Unfunded debt.....	1,945,971	3,246,95
Total debt.....	6,217,971	7,281,101
Cash assets.....	2,704,052	1,837,103
Net debt.....	3,513,919	5,443,998
Cost of construction.....	5,516,994	5,309,173
Cost of horses.....	910,664	928,218
Cost of cars.....	2,655,748	2,503,026
Other articles of equipment.....	1,543,869	5,584,986
Total cost of equipment.....	5,110,281	1,153,742
Real estate.....	6,650,654	5,796,548
Total property and assets.....	19,981,982	17,527,810
Cost of extension of tracks.....	225,004	53,473
Reconstruction of tracks electrical construction, etc.....		556,668
Cost of new horses.....		
Cost of new cars.....	432,788	953,654
Cost of new equipment.....	390,127	479,550
Cost of new real estate.....	860,201	976,905
Total addition to property.....	1,908,121	3,020,250
Property sold or reduced in valuation.....	320,898	240,149
Net addition to property.....	1,587,223	2,780,101
Passenger earnings.....	5,889,180	5,678,390
Rents from other roads.....	13,401	12,986
Received from sale of manure.....	15,864	17,242
Income from other sources.....	50,539	71,464
Total income from all sources.....	5,968,984	5,780,083
Repairs of roadbed and track.....	202,599	285,054
Repairs of cars, horse shoeing, etc.....	316,190	323,082
Repairs of buildings.....	38,396	72,165
Renewal of horses.....	137,565	143,904
Salaries of officers and clerks.....	103,564	77,568
Wages of other employes.....	2,184,695	2,188,440
Provender.....	609,752	490,883
Taxes.....	245,735	222,378
Rents paid other roads.....	12,359	12,465
Insurance.....	16,158	35,517
Damage to persons and property.....	148,592	158,736
Office and other expenses.....	637,532	458,175
Total expense of operating.....	4,703,136	4,468,369
Net income above operating expenses.....	1,265,848	1,311,714
Interest accrued.....	287,539	244,503
Dividends declared.....	888,318	737,000
Surplus for the year.....	89,991	330,210
Total surplus for September 30.....	214,661	355,558
Box cars.....	820	838
Box cars, electric motors.....	297	164
Open cars.....	842	856
Open cars, electric motors.....	172	173
Horses.....	6,796	6,927
Overhead electric equipment, miles.....	81.23	65.46
Underground wiring, miles.....	202.83	8.26
Poles only, miles.....	1,891	1,110
Feeder wire for miles of track.....	9,335	7,419
Electric snow plows and sweepers.....	43	9
Miles of railway (single track) operated.....	23,524	23,470
Total miles run during year.....	17,462,572	17,605,360
Passengers carried.....	119,264,401	114,854,081
Round trips made.....	2,328,274	2,333,570
Persons regularly employed.....	3,885	4,148
Passengers killed.....		3
Passengers injured.....		144
Employes killed.....		2
Employes injured.....		25
Other persons killed.....		10
Other persons injured.....		70

Lynn & Boston Street Railway.

	1891	1890.
Capital stock authorized by charter.....	\$1,000,000	\$500,000
Capital stock authorized by vote.....	700,000	500,000
Capital stock paid in.....	600,000	500,000
Funded debt.....	425,000	425,000
Unfunded debt.....	93,773	103,164
Total debt.....	518,773	528,164
Cash assets.....	49,102	37,577
Net debt.....	469,671	490,587
Cost of construction.....	603,543	568,268
Cost of horses.....	89,500	95,200
Cost of cars.....	121,400	116,600
Other articles of equipment.....	147,370	117,142

Total cost of equipment.....	358,270	328,942
Real estate.....	197,086	176,474
Total property and assets.....	1,208,001	1,111,262
Cost of extensions of tracks.....	35,275	17,031
Cost of new horses.....	5,600	5,600
Cost of new cars.....	4,800	6,400
Cost of other new equipments.....	30,483	54,549
Cost of new real estate.....	20,612	234
Total addition to property.....	91,170	83,815
Property sold or reduced in valuation.....	5,955	8
No addition to property.....	85,215	83,807
Passenger earnings.....	586,071	575,669
Rents from other roads.....	1,918	1,873
Received from sale of manure.....	3,333	3,513
Income from other sources.....	2,500	2,427
Total income from all sources.....	593,822	583,482
Repairs of roadbed and track.....	27,395	46,323
Repairs of cars, horse-shoeing, etc.....	44,521	46,906
Repairs of buildings.....	1,900	1,757
Renewal of horses.....	15,264	19,545
Salaries of officers and clerks.....	15,696	15,070
Wages of other employes.....	231,866	228,471
Provender.....	84,056	67,262
Taxes.....	11,064	9,597
Rent paid other roads.....	25,800	25,029
Insurance.....	4,442	4,234
Damages to person and property.....	5,292	5,250
Office and other expenses.....	54,516	36,553
Total expenses of operating.....	521,812	505,996
Net income above operating expenses.....	72,010	77,486
Interest accrued.....	25,879	26,835
Dividends declared.....	40,000	32,000
Surplus for the year.....	6,131	18,651
Total surplus September 30.....	89,228	83,098
Box cars.....	118	112
Open cars.....	133	130
Horses.....	895	952
Box cars, electric motors.....	8	8
Open cars, electric motors.....	10	6
Electric snow plows.....	4	1
Miles of railway (single track) operated.....	62.24	60.31
Total miles run during the year.....	1,929,523	1,841,285
Passengers carried.....	11,575,368	11,292,333
Round trips made.....	237,193	227,607
Persons regularly employed.....	437	430
Passengers killed.....	0	0
Passengers injured.....	15	10
Employes killed.....	0	0
Employes injured.....	0	0
Other persons killed.....	2	0
Other persons injured.....	2	6

Newton Street Railway.

Capital stock authorized by charter.....	\$30,000	
Capital stock authorized by vote.....	100,000	
Capital stock paid in.....	100,000	
Funded debt.....	100,000	
Unfunded debt.....	30,176	
Total debt.....	130,176	
Cash assets.....	1,633	
Net debt.....	128,543	
Cost of construction.....	152,174	
Cost of horses.....		
Cost of cars.....	48,765	
Other articles of equipment.....	14,317	
Total cost of equipment.....	63,082	
Real estate.....	20,845	
Total property and assets.....	237,734	
Cost of extensions of tracks.....	29,603	
Cost of new horses.....		
Cost of new cars.....	27,952	
Total addition to property.....	56,952	
Property sold or reduced in valuation.....	9,707	
Net addition to property.....	47,245	
Passenger earnings.....	49,376	
Income from other sources.....	563	
Total income from all sources.....	49,939	
Repairs of roadbed and track.....	1,858	
Repairs of cars and electrical equipment.....	5,190	
Repairs of buildings.....	96	
Salaries of officers and clerks.....	2,469	
Wages of other employes.....	14,807	
Provender.....	608	
Taxes.....	387	
Rents overhead line.....	595	
Rent electric motive power.....	7,642	
Insurance.....	545	
Damages to persons and property.....	262	
Office and other expenses.....	3,446	
Total expense of operating.....	37,905	
Net income above operating expenses.....	12,034	
Interest accrued.....	6,955	
Dividends declared.....		
Surplus or deficit for the year.....	5,079	
Total surplus or deficit September 30.....	7,559	
Box cars.....	9	
Open cars.....	12	

Horses.....	2
Miles of railway (single track) operated.....	5.48
Total miles run during year.....	186,543
Passengers carried.....	1,008,803
Round trips made.....	17,051
Persons regularly employed.....	27
Passengers killed.....	0
Passengers injured.....	0
Employees killed.....	0
Employees injured.....	0
Other persons killed.....	1
Other persons injured.....	3

Holyoke Street Railway.

Capital stock authorized by charter.....	\$150,000
Total debt.....	33,445
Cash assets.....	25,229
Net debt.....	8,216
Cost of construction.....	88,203
Total cost of equipment.....	56,466
Real estate.....	27,877
Total property and assets.....	197,775
Net addition to property.....	90,431
Passenger earnings.....	40,765
Total income from all sources.....	41,037
Total expense of operating.....	34,072
Net income above operating expenses.....	6,965
Interest accrued.....	549
Dividends declared.....	3,000
Surplus for the year.....	3,415
Total surplus September 30.....	14,330
Miles of railway (single track) operated.....	5.70
Total miles run during year.....	132,690
Passengers carried.....	833,244
Round trips made.....	29,230
Persons regularly employed.....	30

Fitchburg Street Railway.

Capital stock authorized by charter.....	\$60,000
Funded debt.....	30,000
Unfunded debt.....	1,888
Cash assets.....	2,506
Net debt.....	29,382
Cost of construction.....	69,519
Total cost of equipment.....	19,934
Real estate.....	5,495
Total property and assets.....	97,954
Net addition to property.....	1,249
Passenger earnings.....	31,563
Total income from all sources.....	31,760
Total expense of operating.....	27,387
Net income above operating expenses.....	5,449
Interest accrued.....	800
Dividends declared.....	3,000
Surplus for the year.....	1,649
Total surplus September 30.....	6,066
Miles of railway (single track) operated.....	6.30
Total miles run during year.....	130,454
Passengers carried.....	522,531
Round trips made.....	26,654
Persons regularly employed.....	24

Worcester Consolidated Street Railway.

Capital stock authorized by charter.....	\$350,000
Funded debt.....	150,000
Unfunded debt.....	253,002
Total debt.....	403,002
Cash assets.....	31,828
Net debt.....	371,174
Cost of construction.....	418,195
Total cost of equipment.....	146,295
Real estate.....	179,993
Total property and assets.....	776,312
Net addition to property.....	106,410
Passenger earnings.....	271,061
Received from sale of manure.....	1,473
Income from other sources.....	1,402
Total income from all sources.....	273,936
Total expense of operating.....	223,139
Net income above operating expenses.....	50,797
Interest accrued.....	17,197
Dividends declared.....	28,000
Surplus for the year.....	5,600
Total surplus September 30.....	18,809
Miles of railway (single track) operated.....	21.11
Total miles run during year.....	908,639
Passengers carried.....	6,071,948
Round trips made.....	170,237
Persons regularly employed.....	187

Boston & Revere Electric Street Railway.

Capital stock authorized by charter.....	\$50,000
Funded debt.....	25,000
Unfunded debt.....	14,282
Cash assets.....	5,172
Net debt.....	34,110
Cost of construction.....	70,534

Total cost of equipment.....	9,920
Real estate.....	4,902
Total property and assets.....	90,528
Net addition to property.....	350
Passenger earnings.....	6,697
Total expense of operating.....	4,788
Net income above operating expenses.....	1,909
Interest accrued.....	1,582
Surplus or deficit for the year.....	326
Total surplus or deficit September 30.....	1,246
Miles of railway (single track) operated.....	3.80
Total miles run during year.....	16,950
Passengers carried.....	133,940
Round trips made.....	4,557
Persons regularly employed.....	10

Natick & Cochituate Street Railway.

Capital stock authorized by charter.....	\$25,000
Total debt.....	584
Cash assets.....	9,717
Cost of construction.....	21,550
Total cost of equipment.....	7,418
Real estate.....	4,000
Total property and assets.....	42,685
Passenger earnings.....	12,203
Total income from all sources.....	12,990
Total expense of operating.....	10,170
Net income above operating expenses.....	2,820
Dividends declared.....	1,500
Surplus for the year.....	15,781
Total surplus September 30.....	17,101
Miles of railway (single track) operated.....	3
Total miles run during year.....	43,302
Passengers carried.....	268,219
Round trips made.....	7,217
Persons regularly employed.....	8

North Woburn Street Railway.

Capital stock authorized by charter.....	\$200,000
Capital stock paid in.....	100,000
Unfunded debt.....	32,550
Cash assets.....	4,648
Net debt.....	27,902
Cost of construction.....	88,493
Total cost of equipment.....	21,062
Real estate.....	15,226
Total property and assets.....	129,429
Net addition to property.....	288
Passenger earnings.....	20,536
Total income from all sources.....	20,837
Total expense of operating.....	21,157
Net income below operating expenses.....	270
Interest accrued.....	1,826
Deficit for the year.....	2,096
Deficit September 30.....	3,121
Miles of railway (single track) operated.....	78c
Total miles run during year.....	106,534
Passengers carried.....	405,603
Round trips made.....	9,351
Persons regularly employed.....	18

Quincy & Boston Street Railway.

Capital stock authorized by charter.....	\$50,000
Unfunded debt.....	31,412
Cash assets.....	8,050
Net debt.....	23,362
Cost of construction.....	38,973
Total cost of equipment.....	32,852
Real estate.....	7,745
Total property and assets.....	37,621
Net addition to property.....	3,755
Passenger earnings.....	31,333
Total income from all sources.....	31,868
Total expense of operating.....	31,048
Net income above operating expenses.....	820
Interest accrued.....	1,015
Deficit for the year.....	195
Total surplus September 30.....	6,209
Miles of railway (single track) operated.....	7.56
Total miles run during year.....	115,806
Passengers carried.....	647,202
Round trips made.....	25,392
Persons regularly employed.....	16

East Middlesex Street Railway.

Capital stock authorized by charter.....	\$300,000
Funded debt.....	125,000
Unfunded debt.....	68,063
Cash assets.....	8,760
Net debt.....	184,304
Cost of construction.....	241,331
Total cost of equipment.....	89,802
Real estate.....	58,662
Total property and assets.....	398,554
Net addition to property.....	17,981
Passenger earnings.....	89,421
Total income from all sources.....	90,831
Total expenses of operating.....	79,553

Turning next to motive power the following division of statistics is decidedly interesting.

Items.	All Motive Powers.	Distribution.			
		Animal.	Electric.	Cable.	Steam.
Length of line	5,783.47	4,061.94	914.25	283.22	524.06
Length of all tracks.....	8,123.02	5,661.44	1,261.97	438.31	711.30
No. of cars ...	32,505	22,408	2,895	5,059	2,113
No. of employes.....	70,764	44,314	6,619	11,673	8,158
No. of passengers.....	2,021,010,202	1,227,756,815	134,905,994	373,492,708	286,854,685
Total cost.....	\$39,357,298.87	\$195,121,682.50	\$35,830,949.63	\$76,346,618.23	\$82,058,038.51

Perhaps the most notable feature of the above table is the fact that in 1890 the railways operated by animal power were still far ahead of all others as regards their gross operating statistics. Rapid as was the advance of electric and cable roads during the last five years of the decade, only a beginning was made in the supplanting of the older form of motive power. It is interesting also to see that although both in number and length of lines the electric railways have far outstripped the cable railways, the latter, nevertheless, represent twice as great an investment, operate nearly twice the number of cars and do a business more than twice as great. These relative figures point clearly to the far greater density of traffic upon the cable lines and to their large first cost. The cable lines, almost without exception, operate in the denser portions of the large cities, while the greater part of the electric roads are either suburban or serve the people of comparatively small cities.

The following table which gives a summary of the capital stock, funded debt, dividends and interest, while it cannot be implicitly relied on as showing the condition of every road, may be accepted as being sufficiently correct and indicative for all practical purposes. The year for which the report is made is that ending July 1, 1890

Items.	Capital Stock Issued and Outstanding.	Dividends Declared	Rate of Dividends Declared. Per cent.	Funded Debt Issued and Outstanding	Interest Accrued.	Rate of Interest Paid. Per cent.
All motive powers.....	\$163,506,544.50	\$11,600,334.54	7.09	\$103,494,259.99	\$5,870,710.72	5.67
Animal.....	62,415,651.50	4,390,519.54	7.03	31,361,904.99	1,997,664.92	5.81
Electric.....	4,034,904.00	225,697.00	5.59	3,230,300.00	187,505.00	5.80
Cable.....	6,437,900.00	653,587.00	10.15	4,076,000.00	218,160.00	5.35
Steam.....	25,917,180.00	1,561,512.00	6.03	19,326,200.00	1,181,512.00	6.11
Mixed and Inseparable.	64,700,950.00	4,739,019.00	7.37	42,499,855.00	2,285,368.80	5.38

The receipts and expenditures of all the street railways has been summarized as follows:

ITEMS.	All Motive Power	Animal.	Electric.	Cable.	Steam.	Mixed and Inseparable.
RECEIPTS:						
Grand total.....	\$91,721,844.74	38,403,748.62	\$3,220,396.33	\$3,798,414.36	\$12,709,627.93	\$33,589,637.50
From operation:						
Total.....	90,617,210.71	37,866,930.79	3,215,268.38	3,771,801.78	12,541,249.61	33,221,960.15
Passengers.....	89,711,329.39	37,536,924.08	3,125,871.49	3,718,541.80	12,464,962.10	32,865,529.92
Other sources.....	905,381.32	330,006.71	89,396.89	54,259.98	76,287.51	356,430.23
Rentals and miscellaneous.....	1,104,634.03	536,817.83	5,127.95	26,612.58	165,378.32	367,697.35
EXPENDITURES:						
Grand total.....	87,388,006.65	37,066,110.78	2,994,802.27	3,476,075.55	11,700,492.06	32,150,525.19
Operating expenses.....	62,011,184.93	37,893,077.33	2,266,422.02	2,477,624.34	7,192,671.91	22,181,389.33
Fixed charges:						
Total.....	13,978,902.88	4,700,649.25	450,551.05	564,497.95	2,939,075.36	5,324,129.27
Rentals.....	2,561,342.50	695,232.01	19,436.55	1,525.30	288,631.00	1,636,517.64
Taxes and licenses.....	3,308,190.49	1,674,457.72	59,060.99	77,282.65	501,447.31	995,941.82
Interest.....	8,086,215.99	3,403,736.36	371,865.51	485,690.00	2,148,997.05	2,675,927.07
Miscellaneous.....	23,153.90	7,323.16	188.00			15,742.74
Payments from net income:						
Dividends.....	10,180,726.12	4,039,165.90	188,928.22	333,587.00	1,561,512.00	4,037,533.00
Miscellaneous.....	1,217,192.72	433.22	88,900.98	100,366.26	7,232.79	547,474.39
Total surplus for period.....	5,400,299.07	1,661,194.59	381,900.35	420,335.03	1,167,980.43	1,563,808.67
Total deficit for period.....	1,066,460.98	528,556.75	156,886.29	97,996.22	158,844.56	124,677.16
Net surplus for period.....	4,333,838.09	1,337,637.84	225,014.06	322,338.81	1,009,135.87	1,439,131.51

In conclusion, the balance sheet of eighty-one per cent of the operating roads will be found in the subjoined table:

ITEMS.	All Motive Power.	Animal.	Electric.	Cable.	Steam.	Mixed and Inseparable.
ASSETS:						
Cost of road and equipment.....	\$315,547,761.38	\$121,283,492.18	\$7,840,482.49	\$15,353,698.21	\$66,319,165.49	\$104,750,922.01
Other permanent investments.....	46,830,823.07	5,320,962.22	357,309.23	410,646.48	21,781,166.54	1,360,738.60
Value of franchise.....	14,597,444.00	4,842,362.40	1,225,000.00	1,192,581.60	20,000.00	7,317,500.00
Bills and accounts receivable.....	7,538,199.93	1,877,493.47	46,686.67	24,453.05	3,388,918.53	2,100,668.26
Cash on hand.....	7,774,860.61	4,064,015.98	186,323.25	82,524.56	1,030,295.21	2,411,701.61
Supplies.....	2,157,232.37	801,314.45	31,724.75	73,261.64	346,130.64	994,860.89
Miscellaneous assets.....	10,418,987.85	1,783,546.33	870,033.43	857,035.13	2,151,117.59	4,757,255.35
Profit and loss (deficit).....	3,610,082.15	2,281,954.35	116,055.94	467,358.34	345,222.91	399,490.61
Total.....	\$408,475,451.39	\$142,855,142.38	\$10,673,595.76	\$18,461,559.01	\$95,482,016.91	\$141,003,137.33
LIABILITIES:						
Capital stock.....	\$211,277,798.08	\$77,492,738.29	\$5,705,687.67	\$8,775,854.53	\$44,465,533.34	\$74,840,984.25
Funded debt.....	151,872,289.01	49,226,234.01	3,486,200.00	5,584,500.00	44,369,000.00	49,216,655.00
Bills and accounts payable.....	16,325,347.01	4,928,246.03	1,163,022.84	299,653.41	1,525,841.55	8,410,583.25
Interest due.....	1,013,780.48	379,986.01	18,200.05	21,712.50	290,619.41	303,342.51
Dividends due.....	191,119.25	51,008.81	405.78		45,268.90	94,435.76
Miscellaneous liabilities.....	12,898,218.52	2,366,366.04	156,284.27	2,754,730.59	2,674,488.79	4,886,348.88
Profit and loss (surpluses).....	14,956,898.97	8,412,563.19	146,875.15	1,025,107.93	2,111,264.92	3,261,087.73
Total.....	\$408,475,451.39	\$142,855,142.38	\$10,673,595.76	\$18,461,559.01	\$95,482,016.91	\$141,003,137.33

The "eighty-one per cent." of the street railroads referred to above is all that gave any satisfactory statement in the form of a balance sheet, but it includes most of the important companies, and calculations to fill out the 100 per cent. can readily be made.

Legal Intelligence.

STREET RAILWAY CO.—MUNICIPAL POWER—ORDINANCE—

HEATING OF STREET CARS—POLICE REGULATION. This action sought the prosecution of the defendant street railway Co. for the violation of the following sections in the general ordinance, and subdivisions of certain sections of the City Charter, giving the City Council power, to wit: 1. "To license, tax and regulate local carriers, and all others pursuing like occupation, and to prescribe their compensation. 2. To regulate the police of the city or village, and pass and enforce all necessary police ordinances. 3. To do all acts, make all regulations which may be necessary or expedient for the promotion of health, or the suppression of disease." Under these provisions the city authority claimed ample authority was given by the Legislature to the city to enforce against all street car companies this ordinance in question, requiring them to "cause their cars to be heated sufficiently to make them comfortable for the transportation of passengers at all times when in operation during the months of October, November, December, January, February, March and April of each year." The company defended on the ground that the city had no power to pass the ordinance in question, because such exercise of power was in violation of the contract existing between the State and the defendant railway company, made through the Common Council. The Court, (McConnell J.) construing the evidence.

1. *Held*, That the city of Chicago, under the General Incorporation Law, has no power by ordinance to require the defendant company to cause its cars to be heated sufficiently to make them comfortable for the transportation of passengers during the months of October, November, December, January, February, March and April of each year.

2. That the ordinance cannot be justified as a police regulation; it is an attempt to burden the defendant company with the expense of certain comforts for the benefit of its patrons, and the power delegated to the city by the General Assembly is not broad enough to warrant the City Council to impose this burden upon street car companies.

3. That, whenever the legislature shall pass such a law, it will not be justified as a police regulation, but as the exercise of a power never surrendered by the state. Hence, the ordinance must fail.

People etc., ex rel. v. West Chicago Street Ry. Co., Cook Co. (Ills.) Criminal Court, June 27 1891.

SPECIAL ASSESSMENT—RAILROAD RIGHT OF WAY—STREET RAILWAY PAVING STREET. Where the commissioners appointed to make a special assessment for a street improvement assessed a block belonging to a railroad company, and over which its road ran, in two parts, assessing one part higher than the other, and expressly accepting the right of way. The County Judge, upon application, for confirmation of the assessment modified the assessment, so as to make one assessment on the entire block in an amount equal to the sum of two partial assessments.

Held, 1. That this did not constitute an assessment on the right of way.

2. That assessing separately two parts of an undivided block is not erroneous, where the sum of the two assessments is not more than the benefits received by the entire block. (This case distinguishes the case of *Warren v. Chicago*, 118 Ill. 329).

3. That a street railway company, which is required to pave and keep in repair that part of the street which it uses, is not liable to special assessment for paving the rest of the street. (See, case of *Parmalee v. City of Chicago* 60 Ill. 267) heretofore reported in the STREET RAILWAY JOURNAL.)

Chicago etc. Ry. Co. v. City of Chicago, Ills. S. C., June 15, 1891.

INJURY TO PASSENGER BOARDING MOVING CAR.—Where the plaintiff, a young man in good health and unincumbered, stepped on the side of defendant's open street car as it was moving slowly, and had nearly stopped. And where in about a second, and before the car had gone eight feet, and before the plaintiff had got into the car he was struck by the hind wheels of a truck in the street. There was no evidence that either the driver or conductor saw the truck.

Held, in an action for damages for the injuries sustained that plaintiff should have been non-suited, for the reason that the injuries sustained by plaintiff seem to have been the result of an accident. And, if it was due to any negligence, it was due more to his own negligence than that of the defendant.

Reversed and remanded.

Mayhan v. Second Ave. Ry. Co., N. Y., C. A., June 2, 1891.

Note: This is an important question. If negligence occasioned the injury, which of the two were the more negligent? It was not carelessness for the plaintiff to attempt to enter the car while it was slowly moving. Hundreds of young men get off and on cars daily in perfect safety while the cars are in motion. No negligence can be charged against the company merely because it did not stop the car for plaintiff. But for the wagon standing in the street he would have entered the car in safety. The real question therefore was, ought the company to have guarded the plaintiff against injury from the wagon in the street near its track? It was not bound to know that the wagon was temporarily there, so close to its track that there was danger that a person attempting to get into one of its cars might be injured by being struck. Especially is this true where neither the driver nor conductor saw the truck or perceived the danger. Plaintiff had the best opportunity to see the wagon to which a team was hitched, which was on his side

of the car in plain sight in his immediate presence. If the conductor was bound to guard him against danger so was he equally bound to guard himself from peril. If the conductor was careless, he was more careless. It was his duty under the law to look for himself that there was no obstacle in his immediate presence outside of the car and track which made it dangerous for him to attempt to enter the car while in motion. The negligence therefore of the parties seem to have been compared by the court and the ruling was adverse to plaintiff on that ground.

INJURY TO TRAVELER—TRACK OUT OF REPAIR—DAMAGES—In an action for damages resulting to a traveler upon the street, upon appeal the court

Held, 1. That a municipal corporation, vested by law with control over its streets, is bound to keep the same in good order and condition, sufficiently safe to prevent injury to travelers thereon. And it may grant to a street railway company the privilege of building its tracks and running its cars thereon, with the obligation of keeping them in proper order and condition.

2. A street railway company which neglects to keep its road and tracks in good condition is liable to a party injured by a fall on a loose rail and protruding spike, in consequence of which his skull is fractured or perforated, and death ensues.

3. A party using due care and diligence when using such track has a right to recover from a railway company for injury inflicted by its gross fault and negligence, when the cause is proximate.

Cline v. Crescent City Ry. Co. et al. La. D. C., May 9, 1891.

Note: Here the plaintiff sued both the city and the company for damages, but the court held that the company alone is the responsible respondent.

STREET RAILWAY COMPANIES—THE RIGHT TO USE EACH OTHERS TRACKS—COMPENSATION—HOW DETERMINED.

1. Where a city charter (St. Louis, Mo.) provides that "any street railroad company shall have the right to run its cars over the track of another street railroad company on payment of just compensation for the use thereof, under such rules and regulations as may be prescribed by ordinance; and it shall be the duty of the municipal assembly to immediately pass such ordinances as may be necessary to carry this provision into effect."

Held, that an ordinance having been passed giving the right to use tracks, the only thing necessary to perfect the right was to have the "just compensation" ascertained, as provided by ordinance.

2. Where proceedings under an ordinance provided that when the right to use the tracks of one company has been granted to another company, and the two cannot agree as to compensation, it shall be determined by commissioners appointed by the Mayor, and such act does not involve the exercise of the right of eminent domain.

3. That the charter (Art. 10 Sec. 6) gives the city power to make rules and regulations, not only for running the cars of one company over the tracks of another, but also for ascertaining the compensation to be paid therefor. Hence, an injunction the Mayor restraining him from acting in such matter will not lie.

Union Depot Ry. Co. v. Southern Ry. Co. et al., Mo. S. C., July 29, 1891.

INJURY TO PASSENGER RIDING ON PLATFORM—NEGLIGENCE—

The plaintiff, on account of the number of passengers in the car and upon the rear platform, was compelled to stand upon the front platform of defendant's car, from which he was thrown and received very severe injuries, by his leg being run over and crushed by one of the car wheels. The court took the case from the jury, and directed a verdict for the defendant. Plaintiff appealed, alleging the violation of the following duties:

1. To provide and furnish plaintiff a safe and convenient seat or place to ride while being conveyed as a passenger; and to provide prudent, safe, and com-

petent agents to manage said car and to provide for his safety as such passenger; not to drive such car at such a rate of speed as to be dangerous to such passenger; to have a chain or guard across the passage way down the steps of the front platform extending across the passage way for the safety of passengers, etc.

2. That the driver and conductor wrongfully, recklessly and carelessly, mismanaged said car, by going at a high rate of speed, and without notice or warning to complainant, struck the horses a blow causing them to jump forward, thereby throwing the complainant from the platform, and while clinging and struggling to recover himself and calling to the driver to stop the car, he fell across the rail and suffered a crushed leg at the ankle.

The plaintiff introduced in evidence sections 4 and 5 of the revised ordinances, viz.:

Sec. 4. "Every street railway company in the city (Detroit) shall so inclose and guard the front platform of each car operated and run by any such company within the limits of the city, as to prevent passengers from getting on and off such platform."

Sec. 5. "No conductor or driver on any street railway car, while such car is in use shall permit any person to enter or leave the same by way of the front platform or forward platform; and no person, when the forward platform of any street railway car in actual use is inclosed or guarded, as required in the preceding section, shall enter or leave, or attempt to enter or leave, such car by the forward platform, and no person under the age of sixteen years shall ride on the rear platform of any street railway car, or get on or in the same while said car is in motion."

Testimony showed that no guard or chain was used to protect passengers while on the front platform; that plaintiff was suffered to ride on the forward platform, and that he was thrown off and injured in the manner set out in his petition.

Held, 1. That whether it is negligence in a street railway company not to guard its horse cars so as to prevent passengers from getting on and off the front platform is a question of fact for the jury, notwithstanding that the city ordinances require such cars to be so guarded.

2. Whether a passenger on a crowded horse car is guilty of negligence in riding on the front platform is a question of fact for the jury, and it was error to withdraw the cause, for which error the cause must be reversed and new trial granted.

Archer v. Flwayne & Erie Railway Co. Mich. S. C., July 28, 1891.

Note: In the case of *Upham v. Street Railway Co.* (Mich. S. C., February 27, 1891,) it is held that it is not negligence *per se* to ride on the platform of a street car, though there is room within; and an instruction that this fact will prevent a recovery for an injury to a passenger resulting from the negligence of the street car company is error. In this case the injured party, after finding seats for his companions, returned to the front platform through which they entered, and while standing with his back against the door was thrown to the pavement by reason of the driver striking his horses and going over and around a curve and switch at a high rate of speed.

It is within the power of street railway companies to prohibit passengers from riding upon the platforms of cars or to give notice that those who ride there must do so at their own risk, or to limit the number of passengers which each car shall carry, and to require them to ride inside the cars. Until they adopt some such regulations and notify the public, it is but reasonable for courts to hold them liable for injuries resulting from their own negligent acts, to their patrons who are themselves in the exercise of reasonable care, whether riding upon the platform or within the cars.

THE largest passenger elevators in the world have just been completed at Weehawken, N. J. They carry passengers to the top of the Palisades, 150 ft. above high tide.

The Stillman Light Track Construction.

A short section of the main line of the Wood River Railroad at Hope Valley, R. I., was laid early in November with the Stillman construction, which was illustrated in our November issue. The rail weighs twenty-four pounds per yard, and is laid upon split stringers formed by sawing 6 x 6 in. timbers diagonally. The ties are placed nine feet apart, and the rails are arranged to break joints alternately with the stringers. This construction is said to be standing up well under the traffic, which consists of sixteen trains a day, with locomotives weighing twenty-two tons. This system is essentially a stringer construction, the soil being tamped up thoroughly throughout the entire length of the stringer.

Notes on the Columbian Fair.

COMMISSIONER McCORMICK writes from London that Mr. Armstrong will soon arrive in Chicago, his purpose being to present to the authorities of the Exposition a project to reproduce the Tower of London.

THE Council of the Society of Arts, which is the Royal British World's Fair Commission, have decided to appoint committees on finance, engineering, manufactures, electricity, agriculture, mines and metallurgy, textile industries and transportation, to promote the interests of British exhibitors.

THE Bureau of Construction of the World's Columbian Exposition have contracted for a 100 H. P. Armington & Sims engine for use in connection with their temporary light and power plant. The sale was concluded by the Pond Engineering Co., general Western agents for the Armington & Sims engine.

THE great dome of the Administration building, which will be the most conspicuous architectural feature of the Exposition, and the four smaller domes, will be covered with aluminum bronze, a newly discovered amalgam, which is said to glisten brighter than gold. The contract for gilding the domes has been let for \$54,000.

THE "moving sidewalk" at Jackson Park was tested a short time ago and is said to have worked satisfactorily. It is the invention of J. S. Silsbee of Chicago. To satisfy the Exposition people of its practical value, the company put up an experimental loop of the platform on the grounds. The loop is 900 ft. long and is arranged to seat 900 people.

At a recent meeting of the Western Society of Engineers a paper was read by Mr. A. Gottlieb, defending his work in putting in foundations for the World's Fair buildings at Jackson Park. A disagreement with Chief of Construction Burnham and other World's Fair authorities led to Mr. Gottlieb's resignation as chief engineer of the Columbian Exposition. Mr. Gottlieb claims that his work was in line with the best American practice.

THE *London Times* has completed the publication of a series of four articles, aggregating nine columns, about the Exposition, from the pen of their chief American correspondent, Joel Cook of Philadelphia. The articles are exceedingly favorable in their tone toward the Exposition. Mr. James Dredge, of London, has also begun the publication of a series of Exposition articles in his paper, *Engineering*, which are technical in style and are accompanied by numerous plans, drawings, etc.

THE managers of the Exposition have decided that transportation within the grounds, except by boat on the lagoon and the movable sidewalk, shall preferably be by electric railways. Bids will be asked about January 1 for the construction of five and a half miles of standard gauge track, elevated from twelve to twenty-five feet above the ground, for two stations, including a sort of central station, or union depot at the Transportation Building, and for about thirty electric motor cars and 100 passenger cars.

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We heartily invite correspondence upon all subjects of interest to street railway men. Information regarding changes of officers, new equipment, extensions, etc., will be greatly appreciated for our official directory and news columns. We especially invite the co-operation of all interested to furnish us particulars that the directory may be correct and of the greatest possible value.

Address all communications to

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If Chicago is to Have Electric Railways they must it is claimed, be operated by an underground system. The city authorities will listen to no project which involves the use of overhead wires. The city electrician believes he has solved the problem of operating electric lights by varied conductors, and he stoutly maintains that electric railway wires should be disposed of as effectually. For these reasons conduit systems are of especial interest in the metropolis of the West as the electrical fraternity has sometimes felt it was almost a reproach that Chicago was practically without an electric railway. In the near future two underground systems are to be tested on an extensive scale in the city, and the promoters of the enterprise feel confident they will meet with entire success. The particulars are given elsewhere in this issue. The results of the experiments will be awaited with no little interest by street railway men generally.

A Plan for a Model Power House with the best arrangement of machinery to make it convenient and insure economical practice, is one of the things for which the street railway companies are calling with the advent of the new year. We know of no one branch of electric traction that should receive more careful attention on the part of inventors and engineers than this, and we are sure that a good design will be readily adopted, and result in ample compensation to any one who shall solve the problem. The committee appointed by the American Street Railway Association at its last meeting to report on this subject, will doubtless be able to make valuable suggestions when the report is finished, but in the meantime there is a good opportunity for those who are studying the subject to present their views, and receive whatever credit their design may merit. In this connection it would be well for architects and engineers to work in

harmony. Frequently the architect designs the building out of proportion to the requirements of the machinery, and when the latter is in position its efficiency may be curtailed by some oversight on the part of the architect.

Drivers on Late Night Cars are apt to become very lax in the performance of their duties, and frequently ignore the rules and regulations of the manager, owing, we suppose, to the fact that they are not watched as carefully as the day hands. We recently had occasion to take a long ride late at night over a line on which electric power was employed a greater part of the time, but the all night cars were run on long headway by horses. On this occasion the driver took a boon companion on the platform; then, with a cigar in his mouth he sat on the dash rail and chatted with his friend, apparently indifferent to his duties, while his team was allowed to proceed at a slow walk over the entire route. Such a disregard for the rules reflects not only upon the management, but has a demoralizing effect upon other employes, for an evil of this kind soon spreads to a greater or less extent, and is likely to contaminate the entire force unless promptly corrected. It will be found to be a good practice to overlook the night hands occasionally, but if the superintendent is too much occupied with other duties, he should delegate one of his inspectors or other subordinates to look after this matter. Careful inspection at all hours is the secret of good discipline.

Insurance Against Accident Claims is receiving more careful attention from Street Railway managers than formerly, and we find that those who have taken out policies with reliable insurance companies speak in the highest terms of the results obtained, and of the satisfactory manner in which the latter conduct their business. A policy which protects against all liability for any accident that may occur in the operation of a road enables the company to set apart each year a definite sum for this purpose, which assists in giving a definite basis on which to forecast the year's business. The practice relieves the management of a great deal of time and energy usually spent in investigating and settling claims, and provides that the energies of the company may be spent in the direction of improved service that will result in advantage to the company. In a few instances insurance companies have issued policies to large corporations at too small a premium, resulting in loss to the insuring company, but as the business is developed, more equitable rates will be established, and the plan is generally operating to the mutual satisfaction of both parties. The system, however, is not in high favor with the "contingent fee" lawyers, who are making a practice of trumping up claims against street railway companies.

The Trolley in Brooklyn, N. Y., will doubtless be one of the most important events marking the development of electric traction which we shall have the pleasure of noting during the year 1892, as the Board of Aldermen of that city recently, by a vote of thirteen to four, passed a resolution, in answer to the united application of the different street railway companies, granting them permission to erect poles and equip for electric power. This result of the combined efforts of the companies proves the old adage that "in union there is strength," and also marks the inevitable march of electricity, notwithstanding the strong opposition offered by ignorant and pre

judiced parties. We know of no city in which application for electric traction has been made where the opposition has been so strong, and where the arguments for and against have been so thorough, nor where the defeat of the opposition has been so overwhelming. Of course, now that the action has been taken, a few cry "Boodle" and "Fraud," and fail to see that the justice of the cause has triumphed, as must always follow when people become thoroughly informed regarding the merits and advantages of electric traction. The history of the Brooklyn contest will doubtless serve a good purpose in assisting roads in smaller cities and towns to obtain similar concessions from the authorities. We venture the assertion that neither the Brooklyn companies nor the public will regret the change to electrical traction, and we congratulate the companies that they make the change at this time, when they can benefit by the experience of the pioneer roads, and reap the additional advantages of improvements in motors and reduction in prices of electrical appliances.

The Street Railway Problem in Chicago has assumed such importance that the mayor of the city has found it necessary to appoint a commission to consider the question and to report on the best means of providing additional facilities for the public. We do not think it will be denied by candid observers that at the present time the surface lines in the city are unable to meet the enormous demands made upon them at certain hours of the day. While this statement is generally true, we do not think that the companies deserve the harsh criticism which the local press heaps upon them. The enterprise of the Chicago corporations has been marvelous; they have been lavish in their expenditures for cable construction, and rolling stock; they have been untiring in their efforts to meet the extraordinary demands made upon them. Chicago has had a phenomenal increase in population, and already the World's Fair is beginning to attract vast numbers to the City. The business section of the city is small, and multitudes enter and leave it at practically the same hour. The increase has been so great within the last few months that the surface companies have been fairly overwhelmed. The number of cars on the downtown loops has become so great that the trains almost touch each other in running around the circuit; the capacity of tracks has been taxed almost to the utmost limit. The elevated roads are not completed and the surface companies have become the objects of unmerited abuse. The commission is searching for a remedy, and we trust they may be successful. If they attack the problem in the proper spirit they may accomplish good; but invective and unjust complaint will not aid in the solution. Elsewhere a summary of the situation is presented, and we also give a synopsis of the deliberations of the transit commission.

Street Railway Securities in general are at present attracting the attention of capitalists, and it is highly probable that in the near future street railway stocks and bonds will become the favorite security with investors. Considerable change in feeling among capitalists as a class is highly likely to develop in the early future over the question of investing in street railway stocks and bonds. It is being noted here and on the foreign exchanges that there is an insufficient quantity of good investments on the market to consume the capital seeking

them. Quite a change has been taking place within the past year in investors' minds as to the merit in the securities which have heretofore been most active on our exchanges, and the opinion prevails, that had our crops been moderate or small this year, there would have been a large falling off in investment in steam railway stocks, etc. This is mainly on account of aggressive legislation, and the constant reduction of tariff charges due to the effects of our interstate commerce law, which, strange as it may seem, is throwing the cream of our transcontinental traffic into the hands of the Canadian Pacific Railroad, a matter which is fully explained in the Report of the Internal Commerce of the United States for 1890. Added to the growing discontent in England over our steam railway profits, are the troubles with South American and other foreign securities, which altogether tend to turn European and home capital toward our industrial stocks. Between these and the steam roads stand our street railway securities, which investors as a class have heretofore known too little about. But the striking agitation which extends pretty well all over this country regarding improved methods of rapid transit, is attracting attention to this class of securities, and they seem to promise better returns than the best of industrial stocks.

The Desirability, and consequently, the market value of any class of security, depends in part upon its convertibility. A stock or bond paying regularly six per cent. to its holder if sold in the open market, may not bring so much as a five per cent. stock or bond of equal reliability or intrinsic worth, simply because the latter is issued by a company whose standing is better known by the general public. And just here comes in the difference between the true value and the market value of any stock or bond. The former is based upon the present and future prospects of return on the money invested as well as the security of the capital itself. The latter is dependent upon a number of factors, but primarily, except in the case of inflated securities, upon the appreciation of the true value by the investing public. The more widely the real value of a security is known, the more nearly, generally speaking, will it be convertible, that is, will its true value be obtainable in the market. For this reason, the article in another column on methods of floating stocks and bonds, and the plea toward listing active street railway securities on exchange are worthy of attention. That street railway securities are a popular form of investment when the reliability of the company is well known is shown by the demand for the recent issue of \$2,000,000 Baltimore Passenger Railway fives, where the application at the price named, above par, amounted to \$3,000,000 before the time for subscription had expired. A similar result was experienced a few months ago at the sale of the \$3,000,000 of Brooklyn City Railway five per cent. bonds. Other street railway securities ought to form a popular object of investment. There are many reasons which commend them, in preference to any other type of security. The surest way to keep them before the attention of the public is to put them on the list on the exchanges of some of our large cities. Then purchases and sales can be made easily and a market value will be found, depending upon the worth of the security.

The Underground Rapid Transit Scheme for New York, as proposed, is receiving a good deal of attention from capitalists in the vicinity of Wall Street, and

the weight of opinion seems to be that there is no money in it. People don't want tunnels, say others; the elevated roads are unsatisfactory, but the commissioners suggest nothing better, claim other investors. Note is taken of Mr. A. S. Hewitt's change of opinion after he visited the tunnel system of London. Before that, and when he was Mayor of this city, he favored the tunnel project; now he entirely disapproves of it, saying the bad ventilation of the underground roads and the general discomfort in many other ways is an experience that should not be repeated here. Mayor Grant returns from London with similar ideas and endorses Mr. Hewitt's language against the discomforts of the underground roads of England's metropolis. Other travelers return saying they prefer to go uptown in the open air. These, and many like opinions, which are strengthened somewhat by the fight of property owners along the proposed routes against digging through abutting streets, cause these investors to shake their heads. At the same time they all confess something must be done at once; the values of uptown realty are dependent upon greater rapid transit facilities for getting there. Not alone is New York anxious in this particular, but Chicago is in just as bad a plight, and proposes an extensive system of elevated roads for relief. Philadelphia, too, is crying out loudly for elevated roads, as the only solution of the vexed question of rapid transit for that city. These investors note the success, safety and advantages of our elevated system, and their opinions lead them to confess it is the most meritorious plan devised. While it has drawbacks enough, nothing better is shown, therefore they say greater facilities for extensions and improvements, and for additional elevated structures should be encouraged without delay.

The World's Fair is to be the greatest of all the great fairs that the world has ever known, but the public are only just waking up to the full significance of the undertaking. The grounds which have been set apart for the Exposition are located about seven miles from Chicago, on the shores of Lake Michigan, and embrace an area of more than 600 acres, of which 117 acres will be covered with buildings, some of them of enormous dimensions. The grounds have a frontage of two miles on the lake, besides two and a half miles of interior water course suitable for pleasure craft. The largest building will be about a mile in circumference, with a centre aisle having a clear span of 368 ft. and 206 ft. in height. Within the aisle could be placed the machinery hall of the Paris Exposition, with fifty feet to spare above the roof. The buildings are to be constructed of iron and steel, and will have a total floor space of upwards of 6,320,000 ft. What is being done to provide for a proper representation of the street railway interests at the Columbian Exposition, is a question we are frequently asked, but which we are not able to answer in any satisfactory manner. We hear it rumored that application has been made by the American Street Railway Association for 50,000 sq. ft. of space, but we are of the opinion that three or four times that amount will be required. In fact, two or three manufacturers of street railway supplies have informed us that their exhibit will require more than one-half of 50,000 ft. The attention of those interested in the street railway business is called to the fact that this interest should form no inconsiderable part in the exhibition. A committee to look after the street railway exhibits at the Fair was appointed by the American Street

Railway Association, at its meeting in Minneapolis, in 1889, and consisted of the following named gentlemen: George W. Pearson, Washington, D. C.; G. Hilton Scribner, New York; Charles B. Holmes, Chicago, Ill.; E. B. Edwards, Philadelphia, Pa.; Henry M. Whitney, Boston, Mass.; Thomas Lowry, Minneapolis, Minn.; Charles Green, St. Louis, Mo.; Edward Lusher, Montreal, Can.; William H. Martin, San Francisco, Cal. Two of the above committee, Charles B. Holmes, Chicago, and Henry M. Whitney, Boston, have resigned, and their places have been filled by the appointment of Mr. John B. Parsons, of Chicago, Ill.; and Mr. Amos F. Breed, Lynn, Mass. Although the committee would seem to be late in taking hold of this work, they will no doubt make up for any tardiness by unusual zeal and energy from now onward. Probably the entire committee are not so situated that they can give any amount of time to this work, hence we suggest that a sub-committee of two or three be chosen who will be able to take up the work and give it the attention it deserves.

"I Feel Out of Place," said an official of a street railway company recently, while addressing an association of street railway men; "having come up from the old days of horse power, I feel that my days as a street rail-roader are numbered, unless I unlearn what I have learned and begin again." This position is partly right, but a good deal wrong. Once in the business a person should never allow himself to feel that he is out of place among any class of street railway men. It is well to forget some things relating to former practice, but it is never necessary to unlearn what one has acquired in practice with animal power in order to adapt himself to the requirements of mechanical traction. Neither is it necessary to begin again, for progress is the prime quality that is needed in the development of any system of traction, be it animal or mechanical. Hence, it is necessary to be learning all the time. When one ceases to learn he ceases to be useful, and the study required to become proficient in the use of mechanical power is no more difficult, but, on the other hand, is much more agreeable and fascinating than the study necessary along the old lines. Only recently we took occasion to congratulate the street railway fraternity on the fact that only in a few instances had it been found necessary to make a change in management with the introduction of improved methods of traction. We stated that, in almost every instance, superintendents and managers had broadened out and filled the new positions admirably. In fact, many of them had become experts in their line. No man in the work should allow that he cannot do what others have done. We have in mind certain men who may be said to be pioneers in the service but who stand in the very front of skillful managers, and are to-day doing the very best work of their lives. It is not safe, however, for any to rest contented with past experience and judgment gained in an extended practice. These are useful only as they are made to conform to progressive methods. Experience and judgment are good foundations on which to base new acquirements, but if they are one's only stock in trade, sooner later young men, or men who keep up with the development of the times must succeed to the other's place.

* * * * *

The science of street railway traffic (for it is indeed a science) is new, and just now is subjected to rapidly changing conditions, owing to improved methods of trac-

tion. What was legitimate and judicious a few years ago in the conduct of street railway traffic is now regarded as obsolete, so that the chief requirement in the *personnel* of the urban traffic lines of the country is men *who are alive*, men who will readily change their methods and practices and conform to the correct principles of rapid transit as they may from time to-time be developed.

The Rapid Transit Problem upon which so much attention is concentrated in some of our Eastern cities is also a topic of live interest at present in Chicago. The situation confronting those seeking a solution is given fully in another column, but may be briefly outlined by the statement that the needs of the city have grown faster than the transportation facilities. A special emphasis, however, is given to the problem, in Chicago, by the approaching World's Columbia Fair which will bring a large number of strangers to the city, and which makes it absolutely necessary that some decided steps be taken to secure relief. For its rapid transit Chicago at present depends upon surface lines which are either cable or horse, the two elevated railroads which have been partially constructed on the south and west sides not having yet been opened for traffic. The existing cable lines upon which the greater part of the burden of furnishing transportation devolves are admirably managed and equipped and daily carry large numbers of passengers within the city and to the suburban districts, but during the day, and especially the hours of greatest traffic in the morning and evening, seem insufficient to meet the demands for passage. The managers of these railways have for a long time recognized the present growing needs as well as the extra demands which will be made upon them at the time of the Exposition and have installed many improvements, and at the same time have made application for permission to carry out others, but nothing important of this character has been permitted by the authorities under conditions which would justify the investment by the railway company. In the meantime the present condition of affairs in that city has formed the basis of a number of vigorous attacks in the daily papers and technical press upon the management of the cable railway companies and the cable system of car propulsion. In the city of Chicago several so-called indignation meetings have been held at which denunciations have been freely indulged in and hostile legislation of various kinds threatened, but at which no remedy of a practical nature has been advocated. The claims brought forward by the *Railroad Gazette* and other papers in commenting upon the situation that the cable system *per se* is accountable for the delays, that the system is a failure under the conditions presented in Chicago, and that it is useful only within narrow limits are untenable and absurd. The situation is very similar to that in New York where the elevated roads afford the only rapid transit at present, or in Boston where the electric cars often find themselves blocked; but neither of these facts proves the failure of steam or electric power in those cities. The needs of the city have grown faster than the roads. Capital has been unwilling to open new lines of travel without satisfactory guarantees that it will not be disturbed, and the greed of the municipality in trying to overreach the transportation companies, and not the avarice of the companies themselves, is the true cause of any lack of transit facilities.

Some Methods of Floating Street Railway Bonds and Stocks.

The basis of all street railway construction is the obtainment of the necessary capital. While bonds and stocks issued for such purpose in distant cities, are usually taken up by local capitalists, those who are most interested in the development of the real estate of their locality, it frequently happens, particularly in the rapidly growing towns, that capital can ill be spared for such purposes, owing to the innumerable demands made for its use. Especially is this the case in the South and West, where, in consequence, ready money becomes stringent and high rates of interest are demanded for cash loans. The chief relief in such cases is to seek aid from the large centres, like New York for instance, because there money averages in interest rates less than in any other locality. This is the distinguishing feature which makes New York the financial centre of the country; and the only change in this particular which may be reasonably expected, is when other large centres offer as good or better inducements of the same kind.

It is often a problem to investors who are not strictly intimate with Wall Street methods, why money rates in New York should be so much less than in the newer districts, like, for instance, in the more flourishing part of Texas. There it is a common thing for the National banks to ask from ten to fifteen per cent. to merchants in the way of regular discount; and there the same banks charge farmers from twelve to twenty per cent. for well secured loans. Of course such rates are against the laws of Texas, and National banks who practice this business run great risks. But the profits make these bankers shut their eyes and depend upon intimidation if anybody "kicks." The truth is, the merchants of that locality are glad to get money at any price, because nobody offers it on better terms, and the banks hold well together with their purpose in view. And the officers of these banks say that the borrower who would try and make trouble for them through the courts, would be ostracised at once, and fairly run out of his town, such being the force of established usage in spite of the law.

The problem alluded to then is, why does not the money of the large centres where no such interest rates are obtainable, flow to this district where more National banks have sprung into existence on account of profits than in any other part of the country during each of our recent twelve month periods? The main answer is, that capitalists prefer to loan their money where they can keep their eyes upon it. A New York capitalist learns of the high prevailing rates for the use of money in Texas, but as he is unacquainted with the people and local surroundings of that territory, he prefers to lend in New York at a half or a quarter of the Texas rates; consequently, he refuses to send his money to that state to restore an equilibrium between the two districts.

The result of this state of affairs, which undoubtedly will be remedied before the country gets much older, renders it difficult for many distant cities to build street railways, which, under lower rates for the use of money, would be quickly stimulated into existence. This means, of course, that it is for the immediate interest of all who sell to street railway corporations to aid any practical method by which these outlying districts can be relieved of their money pressure, and it is in behalf of general prosperity to bring this about as soon as possible. Again, it is not commonly expected that street car companies should earn over ten per cent. a year dividends; which percentage, from the New York investor's point of view, is thought exceedingly good. Such earnings cannot well compete with Texas bank loans at higher figures. While some roads pay more than ten per cent. a good many pay less, and it has been observed if the earnings much exceed that figure the populace of such a place are apt to rise up and demand legislative restrictions, through reduction in fares, increased taxes, or in some way so the investor will not reap too large profit—from the people's point of view—on the capital employed.

After a street railway corporation is formed, it often

becomes a subject for discussion among the directors, particularly if they desire an increase of capital for extension, improvements or to change over their system to electric or cable methods of operation, to learn how more money may be obtained with the least cost and trouble. While this is a vast subject requiring extended treatment, which from time to time we may describe in all details, for the moment we will speak of one point only, in relation to placing such stocks and bonds on the public exchanges.

There are no active street railway stocks or bonds on the New York Stock Exchange except those of the elevated road. What purchases and sales of such securities take place, are done privately or by means of what are called street brokers. It costs \$500 to "list" a new stock on the

any business in it ; and that the Exchanges are so wrapped up in the steam roads that the street road stock is lost in the maelstrom. In answer some Exchange brokers claim that "washed" sales, which are no sales, but only pretend to be such, must be resorted to ; but they usually want their one-eighth per cent. brokerage each way, just the same as for real sales ; unless some private agreement can be made to the contrary. Such sales systematically continued, they claim, will so advertise a stock into activity that eventually a good market may be found for it to any reasonable limit.

"Wash" sales are illegitimate and against the rules of all Exchanges, with penalties attached, nevertheless many Exchange brokers say it is the only way to make an unknown stock active. Street brokers claim it costs about ten per cent. of the stock's capitalization to "wash" it properly. That is, if the corporation is capitalized at \$1,000,000, it costs \$100,000 of that through the Exchange to get it before public attention.

There is not much advantage in having a stock listed which is not active, but if it is active and pays regular dividends there are many advantages, not the least being loans can readily be obtained upon it. The trust companies rarely lend money upon inactive stocks, and it is said they know the difference between a stock "washed" into activity and one that is normally active. The secret of placing stock profitably is the same as in every industry ; it must be advertised until people are familiar with its sound. Stocks which nobody has heard of nobody wants at any price. There are stocks and bonds offered in Wall Street every day which possess double the intrinsic value of many of the active stocks on the Exchange, yet they will not bring as much money at auction. This is not right, of course, but it is one of those things that exist, and which all who operate in Wall Street are obliged to recognize. If a stock is active and is fair in quality any trust company will loan money upon it, because they can quickly realize the cash in case of foreclosure, but offer them bonds which may be three times as valuable intrinsically, and if there be no active market for them on the Exchange these trust companies will

not advance a cent on them in the shape of a loan. The big banks reason the same way on the subject. J. M. B.



FIRST NEW YORK ELECTRIC ROAD—SECTION SHOWING TRACK CONSTRUCTION.

New York Stock Exchange ; and \$250 on the New York Consolidated Exchange. The brokers on the larger board charge one-eighth of one per cent. each for either buying or selling ; while the Consolidated brokers ask one-half that rate or one-sixteenth each way. The advantage to a street railway company in "listing" its securities, is the advertising it affords, and, what is more important, the ready cash market thus afforded for selling more securities or for borrowing purposes. Besides this, many stocks are increased in value by legitimate manipulation ; about this particular we may speak at another time.

Street brokers buy and sell outside of the Exchanges, by means of verbal, written and printed communications, with investors in all parts of the country. These street brokers are all brokers, not members of the Exchanges, or who, being members, additionally do an outside business. Commonly street brokers ask \$100 to introduce a stock through their correspondents, in addition to the brokerage for selling or buying, which may be either of the above rates, according to who the broker is. The street brokers say that a street railway stock should never be listed on the Exchanges, if a company desires to find an active market, and the Exchange brokers say, the only way it can be done is by means of the Exchanges. The street broker claims that a street railroad stock put on the Exchange sinks it out of sight, and prevents him from doing

The First New York Electric Road.

Work on the electric railway which is being installed in New York City, The Harlem Bridge, Morrisiana & Fordham, is being pushed rapidly under the management of the engineer, Mr. L. H. McIntire. In the accompanying illustration is shown a view of a section of the track in process of construction. As will be seen, ties, stringers, and tie rods are used, the ties being spaced 3 ft. apart. The rails weigh 65 lbs. to the yard, are side bearing, and were furnished by William Wharton & Co. Copper rail bonds riveted through the web of the rail, and without any supplementary centre wire, are used for the return circuit.

A portion of the line extends under the elevated railway of the Suburban Rapid Transit Co., and it is the intention of the managers of the road to carry the trolley wires upon special tie rods attached to the lower portion of this structure. Elsewhere iron lattice poles supplied by Milliken Brothers will be employed to support the overhead wires.

The power house will be located on the Bronx River, West Farms, and will have a dock with a frontage of 350 ft. The building will be of brick with sandstone trim-

mings, and will have a length of 235 ft., with width of forty-five feet. Its height will be one story and a half. The chimney will be 150 ft. high. Power will be supplied by six compound, condensing Corliss engines having an aggregate capacity of 5,000 u. p., and furnished by the Watts-Campbell Co., of Newark, N. J. A large four story car house 200×350 ft. is also being constructed, and will be equipped with a huge elevator for raising and lowering cars to the different floors. The rolling stock to be equipped electrically consists of 300 cars.

Thomson - Houston motors will be used.

A Promising Rail.

The section of track on lower Fourth Avenue, New York, which was recently relaid with the Duplex rail, offers a remarkably smooth way for the passage of cars which cross this section, and is so free from the usual jolting at the joints that the feature is frequently noted by the passengers. Having had the pleasure of a ride over this line recently, we are pleased to add our personal testimony to the popular verdict. This track has not been long enough in service, however, to prove all the claims made for it (a limit of time not less than a year being necessary for any rail to develop its weak points), but it has many promising features. From what we have said in our columns of the almost universal failure of the ordinary rail joint, it will be seen that the call for the railway joint that will stand up under electric service is a pressing one.

The chairs of the Duplex rail are designed to rest on a concrete block 12 × 12 × 4 ins., which are made of the best material and fully seasoned before put in place. The tie rods are placed three feet eight inches apart and between every other chair, so there is little chance for the rails to spread.

Since the Fourth Avenue track was laid, the Duplex Track Co. have contracted to equip a section of road with their rail in the city of Richmond, Va., and have also made a contract to deliver several tons of rails to the North Chicago Railway Co. These will be put in service at once should the weather permit; if not they will be laid in the early spring.

Among other advantages, it is claimed for this rail that it will not be necessary to bond the rail for electric traction, nor will it be necessary to provide a supplementary wire return, the lap joint and keys making virtually a continuous return. In proof of this claim we quote the following communication from an expert to the editor of the *Electrical Engineer* :

NEW YORK, Dec. 24, 1891.

SIR: I have examined, according to your request, the section of track furnished to the Atlantic Avenue Railway Co., Atlantic and Third Avenues, Brooklyn, by the Duplex Street Railway Track Co.

The track is so keyed together for the purpose of securing mechanical continuity and strength that electrical continuity is at the same time secured, thus rendering the track a good electrical return for trolley or conduit roads, without any other bonding than that which is a part of the system and which does not involve extra expense, as do the ordinary methods of bonding.

I made a bridge test of the above mentioned section and found the resistance too small to give an indication on the bridge, although the latter showed .001 ohm very plainly. The test current had to pass through two keys and around one complete joint.

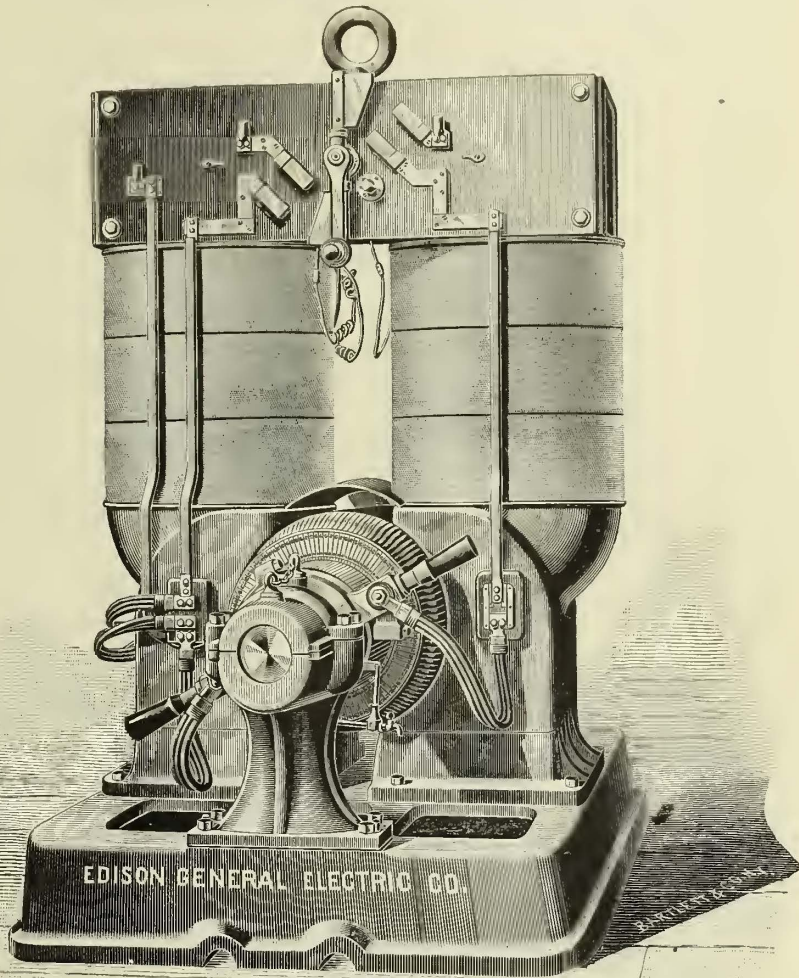
I think this track, when properly laid, will be found practically equal to a continuous rail both mechanically and electrically.

Yours sincerely, TOWNSEND WOLCOTT.

EACH of the 600 employes of the Rochester (N. Y.) Railway Co. was remembered by John N. Beckley, the president of the company, who presented each with a Thanksgiving gift.

Two Hundred Kilo-Watt Edison Generator.

In the accompanying illustration is shown the latest form of Edison railway generator of 200 kilo-watts capacity. As will be seen, it is of standard bi-polar type, the general features of which are so well known as to need no further description. To adapt this generator to the demands of electric railway service, its field has been supplied with a compound winding, easily adjustable to meet the necessary requirements by means of a shunt coil, which



TWO HUNDRED KILO-WATT EDISON RAILWAY GENERATOR.

is conveniently placed in the back board of the keeper. The close adjustment obtained by this arrangement greatly facilitates the operation of generators in parallel, and forms one of the characteristic features of this particular type. The series field is composed of sections wound on spools, which are slipped separately over the cores, and then properly connected. In the event of a fault occurring, the spool in which it develops can be removed and another substituted at once; this not only prevents delay, but makes any repairs necessary a matter of comparatively small expense. The centre of gravity of the armature being low, due to the bearings being located close to the base frame, great stability is secured. Self oiling bearings and carbon brushes help to reduce to a minimum the attention necessary to the operation of the dynamo.

On November 1, the records of the Edison General Electric Co., showed installations of these railway generators the total capacity of which amounted to 52,822 H. P.

It is stated that the steam power of the world is equal to the strength of 1,000,000,000 men, or twice the number of working men that exist. The horse power of England, as regards engines, is estimated at 7,000,000; of the United States, 7,500,000; Germany, 4,500,000; France, 3,000,000; and Austria, 1,500,000. These figures do not include the horse power of locomotive engines, of which it is estimated that last year there were in the whole world 105,000, representing horse power from 5,500,000 to 7,000,000.

The Walker Manufacturing Co's Works and Products, Cleveland, O.

The accompanying engravings illustrate samples of products and interior view of the machine shop of the above works, the latter showing the equipment which enables the firm to turn out the ponderous machinery which has given the works a world wide reputation. The rope drive wheel, which is illustrated in Fig. 1, is one of four of equal size which the firm have recently manufactured under a sub-contract from the Pennsylvania Iron Works

Our readers are already acquainted with the fact that extensive new shops have been erected by the company during the past year, a partial description having been given in the April issue of the STREET RAILWAY JOURNAL, and an account of the formal opening in the July issue; but in order to form a correct idea of the vast extent of the works one must necessarily make a journey to Cleveland and visit the plant.

The new buildings cover about nine acres of ground and are fire-proof, being constructed entirely of brick, iron and glass. The works are situated in the west suburbs

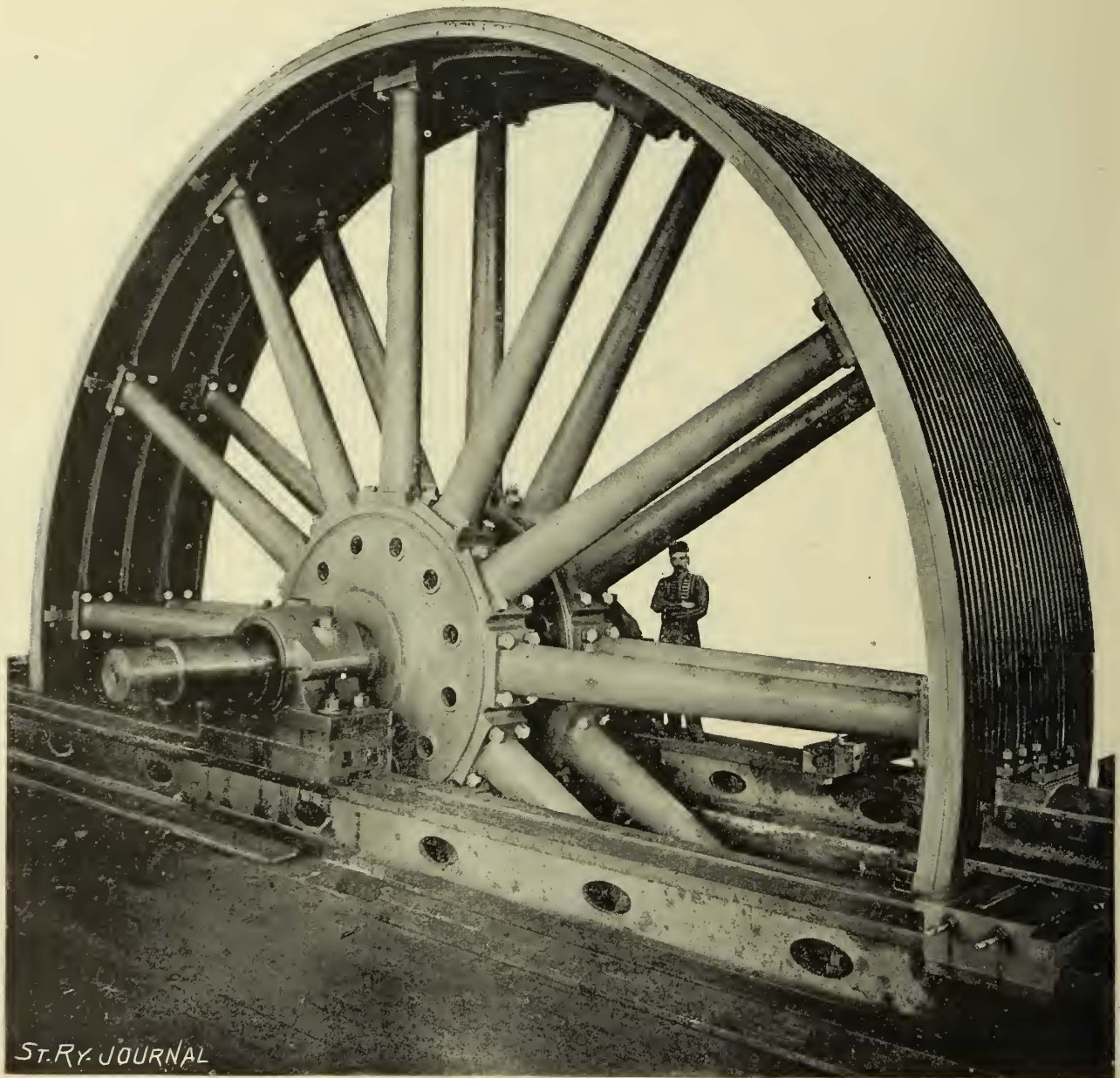
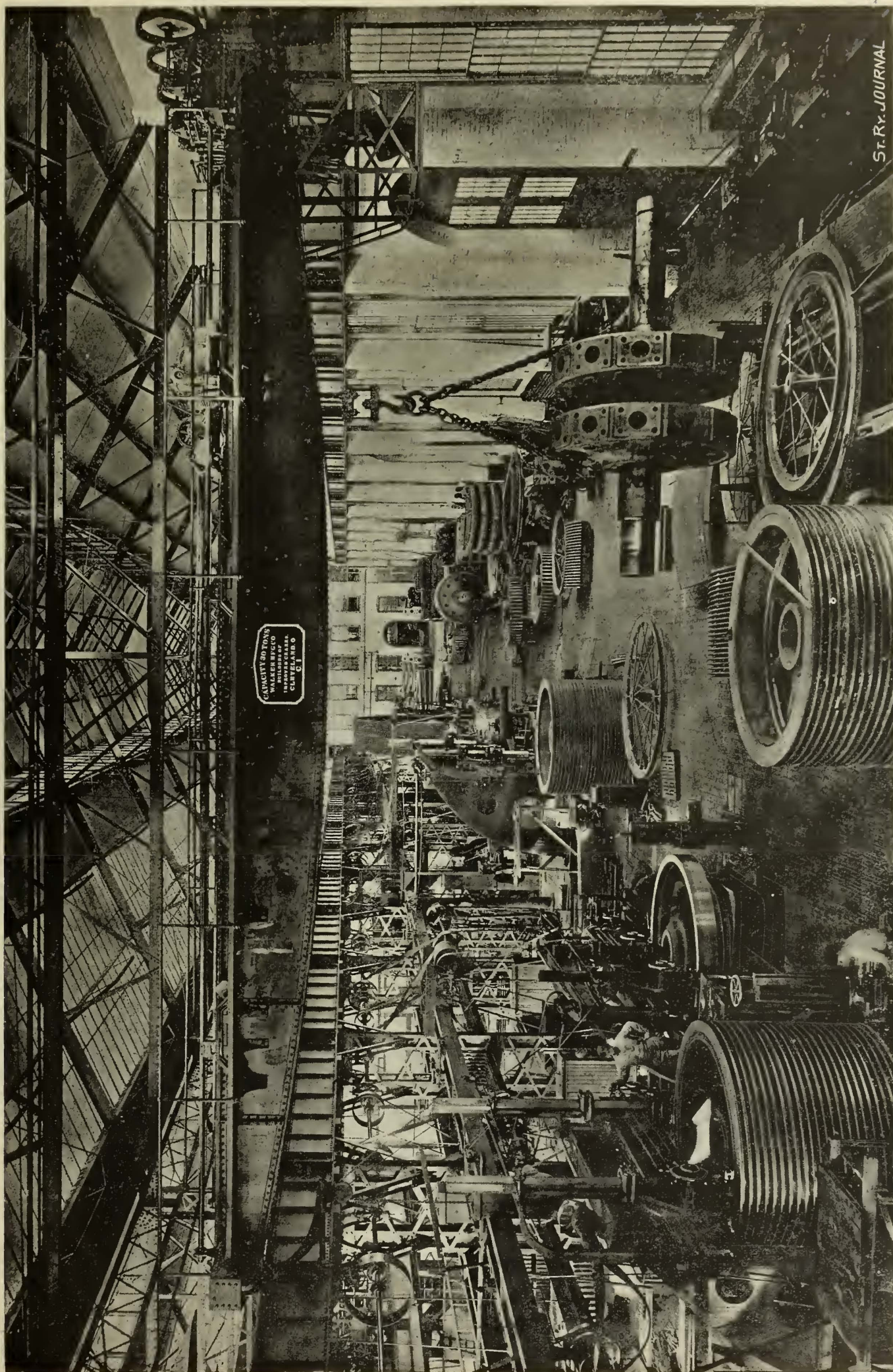


FIG. 1.—SEVENTY-FIVE TON, THIRTY-TWO FOOT ROPE WHEEL FOR THIRD AVENUE (N. Y.) CABLE POWER STATION.

Co., for the power plant of the Third Avenue, N. Y., cable railway. These wheels are thirty-two feet in diameter, with a six foot one inch face, and are provided with thirty-two grooves for driving two and a quarter inch cotton ropes, the entire weight being over seventy-five tons. A large number of pinion wheels, being a part of the same order, are shown in different positions on the floor of the machine shop, and the large drum is also shown in position in the pit lathe in the rear of the shop. Although this firm have made a specialty for some years of cable railway machinery, including the Walker differential drums, which have made the name of the company a familiar one in street railway circles, 116 of which have already been put in operation, this line of work is by no means the exclusive product of the shops. They also manufacture hydraulic machinery of every description and large pulleys and gears for factory equipment.

of Cleveland and face on Waverly Avenue, near the shore of Lake Erie. The walls present a continuous front of about 432 ft. The machine shop proper is about 170 ft. wide and is divided into three bays, one of which is illustrated in Fig. 2, each having a separate roof, supported by iron columns, placed twenty-four feet apart longitudinally. Two of the bays are 280 ft. long and the third is 430 ft. long; but it is the intention ultimately to extend them all to 500 ft. Each bay is equipped with an improved thirty ton traveling crane, which was manufactured by the company, and with modern tools, together with an enormous pit lathe capable of swinging a pulley thirty-two feet in diameter and eight feet face. Between the machine shop and foundry buildings is an open yard, having an ornamental wall and arched gate connecting the buildings and making the front a continuous wall along the avenue.



ST. RY. JOURNAL

FIG. 2.—INTERIOR OF MACHINE SHOP—WALKER MANUFACTURING CO

No. 1 foundry is 118 ft. wide and 300 ft. deep, divided into three bays, the centre one being fifty-seven feet wide and the side bays twenty-six feet wide. The height of the centre bay is forty-one feet to the tie beams and sixty-two feet to the top of the skylight. Two thirty ton, rope drive traveling cranes are erected above the main floor, and in the side bays are four twelve ton traveling cranes. No. 2 foundry has five six ton cranes, and between it and No. 1 foundry is a second building thirty-four feet wide. Besides the cranes, the foundry equipment consists of the most improved machinery and appliances known to the art. There are four cupolas, three of them being, respectively, fifty-two, sixty and seventy inches inside diameter, and having an aggregate output of forty tons of iron per hour. The cupolas are equipped with the Walker patent door. The mechanism for supplying the air blast of the cupolas is of peculiar design, and is the same as has been in successful operation for years in the old foundry. The blast is generated by three cylinder, vertical blowing engines, the air cylinders being 48 × 30 ins., and the cylinder of the steam engine for driving the compressor is 14 × 30 ins. The engine and machinery were built by the company. A very elaborate system of hydraulic elevators is provided for elevating the material to the cupolas, and is automatic in operation. The accumulator is fourteen inches in diameter, with fourteen foot stroke. The casing is loaded to secure a pressure of 1,000 lbs. to the square inch. The differential pumps operate automatically according to requirement, and will work to a speed of 150 revolutions per minute, without pounding, when necessary. The elevator cages and guides are of iron, and the cage is capable of sustaining a load of 12,000 lbs. The entire hydraulic machinery employed was built by the company under the direction of Mr. E. W. Naylor. The manufacture of hydraulic machinery is an important part of the output of the works. The foundries are supplied with an elaborate system of water pipes and tanks, with suitable hose connection for sprinkling the moulding sand and for other uses.

There are five permanent casting pits, four of them being, respectively, twelve, sixteen, twenty and twenty-four feet in diameter and four feet deep, in which large pulleys, drums and gear wheels are cast. The fifth is twelve feet in diameter and twenty-five feet deep, for casting cylinders and other end work, the traveling cranes being of sufficient height to lift a casting from the twenty-five foot pit and place it in any portion of the foundry. There are two core ovens, one 24 × 30 ft. and the other 20 × 30 ft. These are connected by a passageway with the ovens of the old foundry. The ovens have each double tracks, arranged with two trucks on each track, and are so arranged that all of them can be joined together and operated simultaneously, each being provided with a crank and gearing, so that they are readily moved by one man. The ovens are fired from the back and have covered fireplaces inside to shield the cores nearest the fire. Flues are provided under the oven floor, with openings near the top, the openings being larger as they approach the top, in order to equalize the heat at both ends of the oven. The usual smoke and damp chimneys are used, and an additional damper is placed at the top of the oven to let off the smoke and heat before the doors are opened, thus cooling off the oven more readily and preventing the smoke and heat from entering the foundry when the doors are open.

The gearing and moulding machinery with which the foundry is equipped is complete in every detail, including both fixed and portable machines, also striking machines of the most improved form, all of which were invented by Mr. John Walker, general manager of the company. The crane ladles are very substantial, and range in capacity from three to twenty-five tons, and are so arranged that the metal can be poured from either side and from any position that may be necessary. The sand pits, of which there are fourteen, for storing the various kinds of sand, consist of brick arches built under the yard, but opening into the side of No. 1 foundry. The sand pits are drained by a six inch pipe, thus keeping the sand always in good condition. A narrow gauge railway is constructed in the

yard, and by means of turntables leads to the elevators and other points where material is to be delivered.

The general offices for the accommodation of the officers and their assistants are situated at one corner of the machine shop, on the ground floor, front, and are 75 × 57 ft., and are divided into four compartments. The walls are fire-proof, and the interior is finished in antique oak. The windows are of orange colored cathedral glass, giving a rich tint to the interior. In the rear of the general office are the fire-proof vaults for storing valuable records. This room runs the whole length of the office, and is divided by a passageway twelve feet wide. On each side of the passageway are sixteen foot brick vaults, with massive iron doors, the doors being 5 × 6 × 14 ft.

The draughting room is located over the office, and is reached by a stairway, the steps of which are of iron, with a rail of polished oak. The draughting room, which is of the same size as the general office, is lighted both from the sides and roof, and is provided with gas and electric lamps. The furniture of the draughting room consists of twenty-four tables, and the interior is finished in the same style as the office below, and the floors are covered with the best quality of Linoleum cloth, which serves to deaden the sound of footsteps. Adjoining the draughting room is the blue print room, which is well appointed and equipped with all the necessary appliances for reproducing the tracings. In the rear of the draughting room are the fire-proof vaults for storing the blue prints and tracings of the same size and number as the vaults of the room below. Above the draughting room is the office dining room and library. There is also a coat room and lavatory for the use of the employes.

Electric Street Car Heating.

BY W. R. B. WILLCOX

During the past three seasons nearly 100 electric roads in this country and Canada have tried electric heaters and found them in every way satisfactory. In certain cases the heaters have been reported inefficient, but examination has revealed the fact that in each of these cases the trouble lay with the traction company. Regarding one case to which we refer, the heaters had been set up within the paneled car seats, with a single small opening for the passage of heat to the interior of the car, by far the greatest amount of heat thus being confined beneath the seats. A less apparent but surer cause for inefficiency was discovered in another case. Heaters were ordered to be operated upon the so-called railway or 500 volt circuit, when, in fact, the maximum E. M. F. did not exceed 420 volts. Since a proper relation between the resistance of the heaters and the voltage of the circuit upon which they are to be used is the principle of the heaters' operation, the importance of having the one correctly adapted to the other is evident. It is perfectly practicable to construct a heater for a circuit of any voltage, but, if made for 500, it is furnished with only 420 volts, it is like feeding a stove with a spoon—a lump at a time.

The heater customarily used consists of two corrugated iron castings, holding in the intervening space resistance wire so protected as to prevent its oxidation. Four such heaters, twenty-seven inches long by eight inches wide, mounted upon iron legs raising them four inches above the floor, comprise the equipment for an ordinary street car. They are placed two at each end of a car, under opposite seats. The group is so wired that, with the combination switch furnished with each set, they may be operated either in parallel series of two or in direct series of four. Provision for such an alteration in circuits is made in order that a car may be heated rapidly before starting on a trip, while during the time it is out a continuous current of lesser amperage may sustain a comfortable temperature. No. 10 or No. 12 triple braid, weather-proof wire should be used in connection with the heaters. Leaving the main circuit on the line side of the motor switch, it should pass from heater to heater and make its ground connection at the regular ground binding post on the car truck. Best results, furthermore, are

obtained when the heaters are set within tin cases, so constructed as to reflect the heat into the car and prevent, as far as possible, any distribution beneath the car seats. In cases where the seats are paneled, the panel directly in front of each heater should be removed, and the reflectors so arranged that all the heat from the heaters will be reflected through their respective openings. While not necessary, an improved appearance is obtained by having screens fitted to the openings. The electric heater is a perfectly clean device, the dirt and smell of the regulation car stove being wholly absent. There is no combustion whatever inside the car. Therefore the accidental firing of a car from its heating apparatus, and the consequent loss of equipment, is an absolute impossibility.

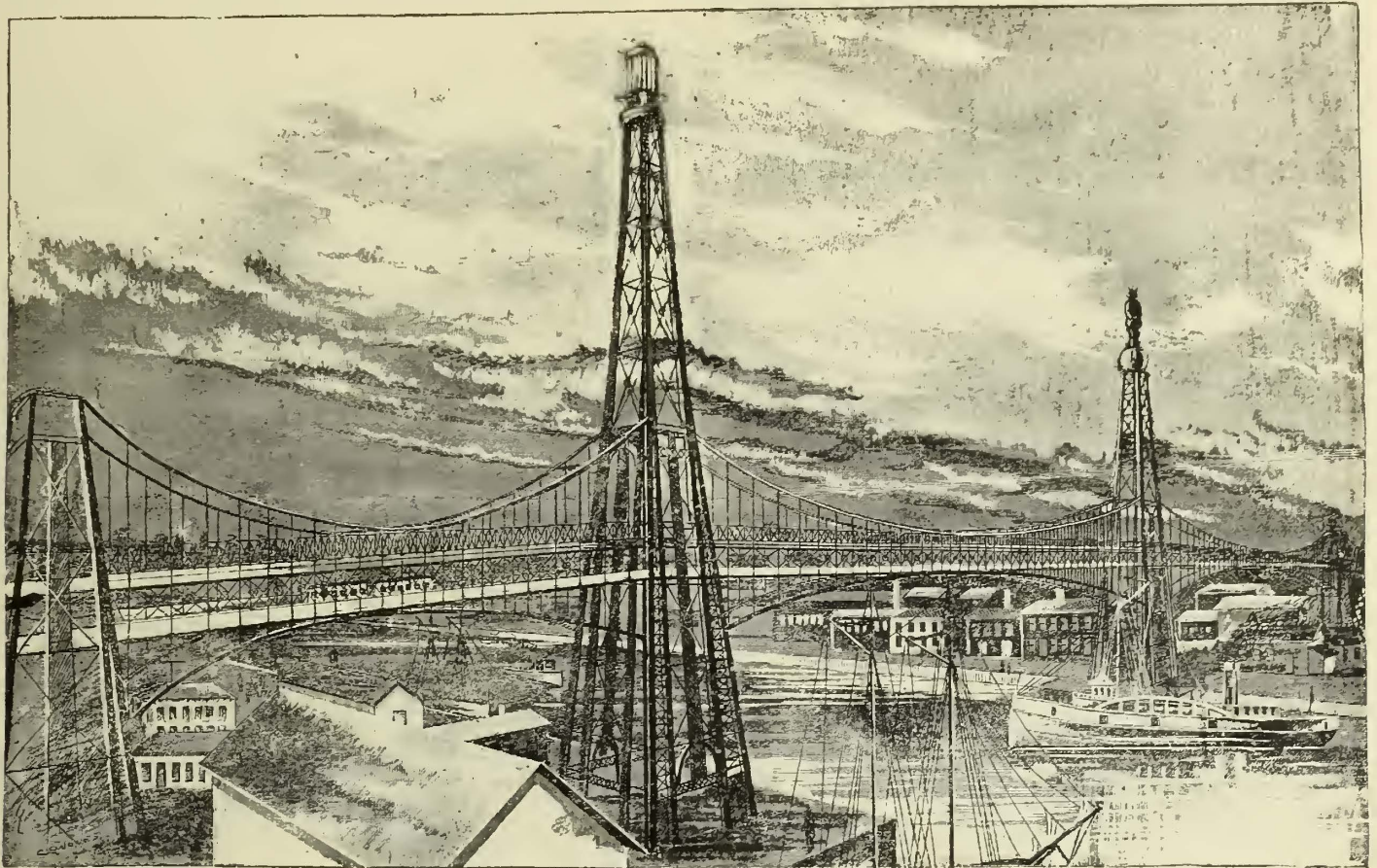
While an electric heater combines all the desirable

tant, indirect benefit, due to the honest appreciation of the patrons of the road of such a desirable and convenient system of heating.

Proposed Suspension Bridge at Chicago.

Among the proposed means of promoting rapid transit in Chicago is one which contemplates the connection of the north and south side boulevards of the city by a system of bridges. To fulfil the conditions demanded by such a system, the Day method of bridge construction has been devised.

As will be seen, this is a new departure in the suspension principle for bridges, its characteristic feature being a second pair of cables curved upward and con-



PROPOSED BRIDGE AND ELECTRIC RAILWAY—CHICAGO.

points of an ideal heating contrivance, giving abundant and evenly distributed warmth and at the same time being absolutely safe, its one grand feature is economy. Stoves last on an average about three seasons, and frequently during that time their consumed parts must be replaced. They require the purchase and cartage of a particular kind of fuel, and in addition considerable attention of conductors. They shorten the life of cars by frequently burning and scorching the car ceilings. The electric heater, on the other hand, will last longer than the car in which it is placed; it cannot injure the car in any way; and with the least care it will never need refitting. If, when heating rapidly, the heaters remain in parallel circuit for more than thirty minutes at a time, there is danger of oxidation of the resistance wire, when, of course, new wire would be necessary. Such loss, however, would only result from pure carelessness. With the electric heater the same fuel which furnishes light and motive power for a car also warms it. Indeed, since it can be so, why for the sake of either light, heat or motive power, shovel coal in two places? All the work attendant upon the use of electric heaters is the movement of a simple switch, conveniently placed upon the hood of the car, which requires not three minutes per day.

It may be added that not only does a direct benefit accrue to a street line by the use of electric heaters, because of their unquestionable merits, but also an impor-

ned with the upper cables by vertical or oblique tension members. By this means a complete tension frame is formed with rigidity sufficient to resist flexure in any direction and avoiding the so-called elasticity which is the characteristic of most suspended structures.

From some figures on the weight of structures by Prof. Fleeming Jenkins, a 400 ft. single span, such as is proposed for this bridge, would, neglecting the roadway, weigh as a simple suspension bridge eighty-three tons; as a girder bridge, 475 tons. With the addition of the lower cables, as in the Day system, there will be, of course, an increase in the weight of the structure, but there will still be a large margin in its favor as compared with the girder type of bridge.

The present plan provides in connection with the 400 ft. span for a pair of handsome towers 400 ft. high, to stand on either side of the river, the one surmounted by a lighthouse and the other by a colossal statue of Columbus. Elevators at cross streets give access to these bridges, whose aggregate length will be more than a mile, and the elevator shaft will be placed in the supports of the span.

The height of the bridges will prevent any interference with shipping, and the grade be so arranged that it can easily be ascended by horses drawing a heavy load.

A company has been formed with an aggregate capital of \$19,000,000, and it is to be hoped that construction will be begun in the near future.

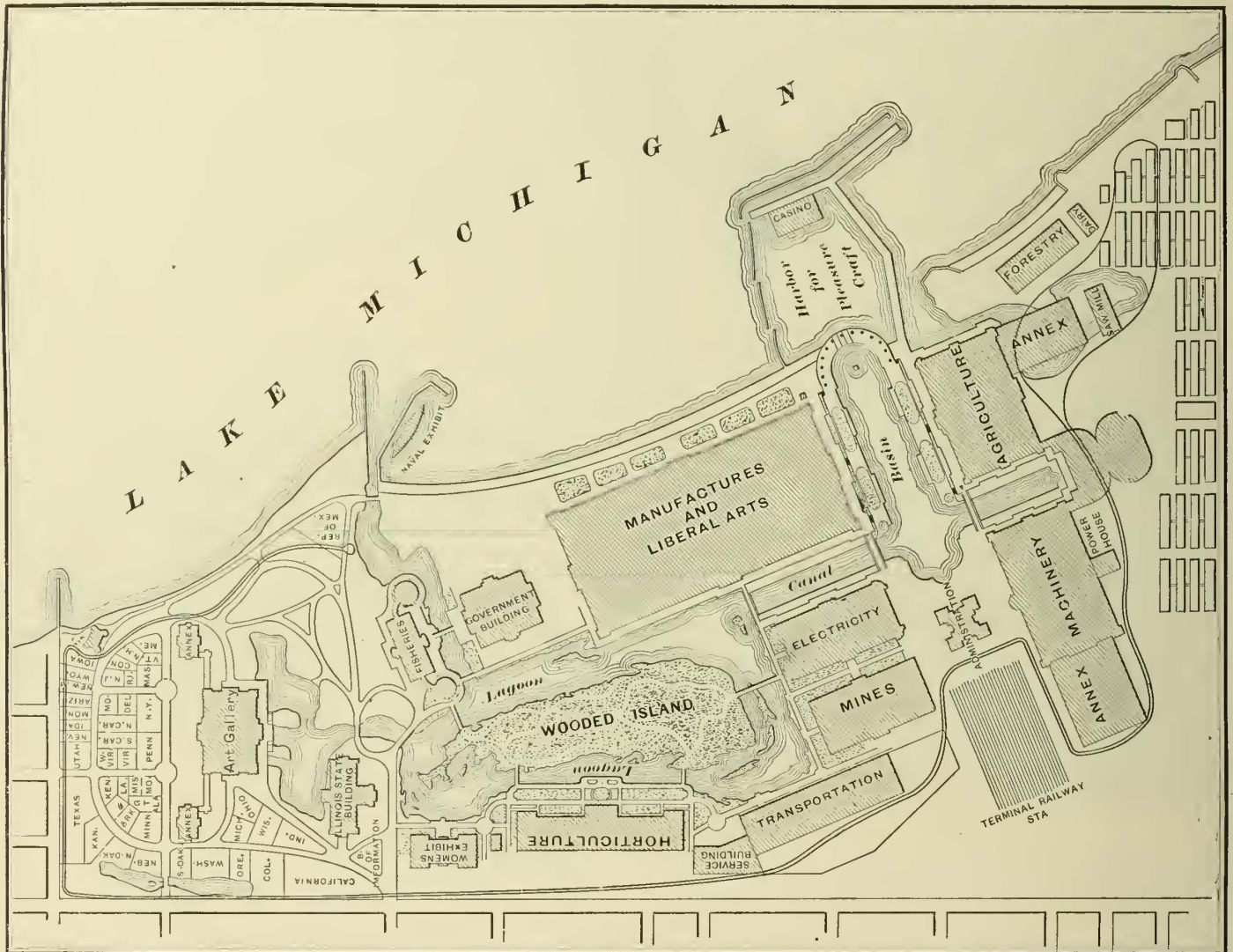
Means of Transportation in the World's Fair Grounds.

The principal means for transportation in the World's Fair grounds will be an elevated railroad. This has been generally agreed since the Fair project took definite shape. The authorities are opposed to tracks upon the grounds. There are to be found persons who do not entirely agree with the Exposition authorities in this matter. They contend that visitors at the Fair would prefer to walk from one building to another rather than to climb a stairway to reach an L station.

The proposed route of the road is shown in the accompanying diagram. This has not been decided upon

sitions from all companies explaining transportation systems are desired. The construction department only specifies the general conditions that the systems shall be safe and not unsightly. The propositions will be passed upon by the construction department, which will recommend that a certain system be adopted. The road will either be purchased by the Fair company and give the bidding company a certain percentage of the receipts, or it will allow the bidder to construct the road, taking a certain percentage of the receipts as consideration for the franchise.

While the elevated road will be the principal means of transportation, a number of companies are seeking for privileges. P. J. McMahon is anxious to operate his am-



MAP OF JACKSON PARK, SHOWING PROPOSED ROUTE OF ELEVATED RAILWAY.

definitely, but in all probability no radical change will be made.

The specifications call for a road five and one-quarter miles in length. There will be a double track with a loop at each end, as shown in the drawing. Standard gauge has been specified. Twenty-four stations have been provided, with a Union depot at the Transportation Building. An equipment of thirty motors and ninety coaches is called for. It is estimated that with this rolling stock a train can be dispatched every minute, making the circuit in about thirty minutes.

It has generally been assumed that electricity would be adopted as the motive power; in fact a number of statements to this effect have been published. It is true, undoubtedly, that the Fair officials are in favor of electricity as an agent for furnishing power for all purposes practicable within the grounds, but they have not committed themselves in the case of the elevated railway.

In all probability the construction department will soon issue a circular calling upon those interested to submit propositions of this elevated railway. Propo-

monia engine on the grounds. Mr. McMahon is alternate Fair Commissioner from Louisiana. The International Railway Co., which is exploiting the Applegate underground electric railway system, is desirous of illustrating the scheme on an extensive scale within the enclosure. The Movable Sidewalk Co. wishes to install several miles of its interesting system on the grounds. The company has now in operation a small exhibition plant at the Fair grounds. The system has been frequently described. It consists of a walk built in parallel sections, each of which moves at a different speed. The outside one may move at two miles an hour, the next at four miles, and the third at six miles. One can step from the ground to the first section or from one section to another without receiving any perceptible jar. If a system of walks of this kind were built the company thinks it would greatly facilitate the movement of visitors. The plant at the Fair grounds at the present time consists of two sections, one moving at two and a half and the other at three miles per hour.

During the Fair visitors may go from one part of the

grounds to another in electric launches, which will navigate the lagoons. There will probably be sixty of these boats, which will be sold outright to the Exposition company or be operated by a company giving a percentage of its results to the Fair.

Outside of the Electricity Building an electric railway will be operated. The track will be about a mile and a half in length. It will be a purely exhibition road, and no fares will be collected. It is proposed to show overhead systems, conduit systems, and storage battery systems. The road will probably be so built that cars will have to travel a five and a ten per cent. grade.

Inclined Planes as a Feature of Rapid Transit.

The Souvenir edition of the STREET RAILWAY JOURNAL which was issued in honor of the Pittsburgh Con-

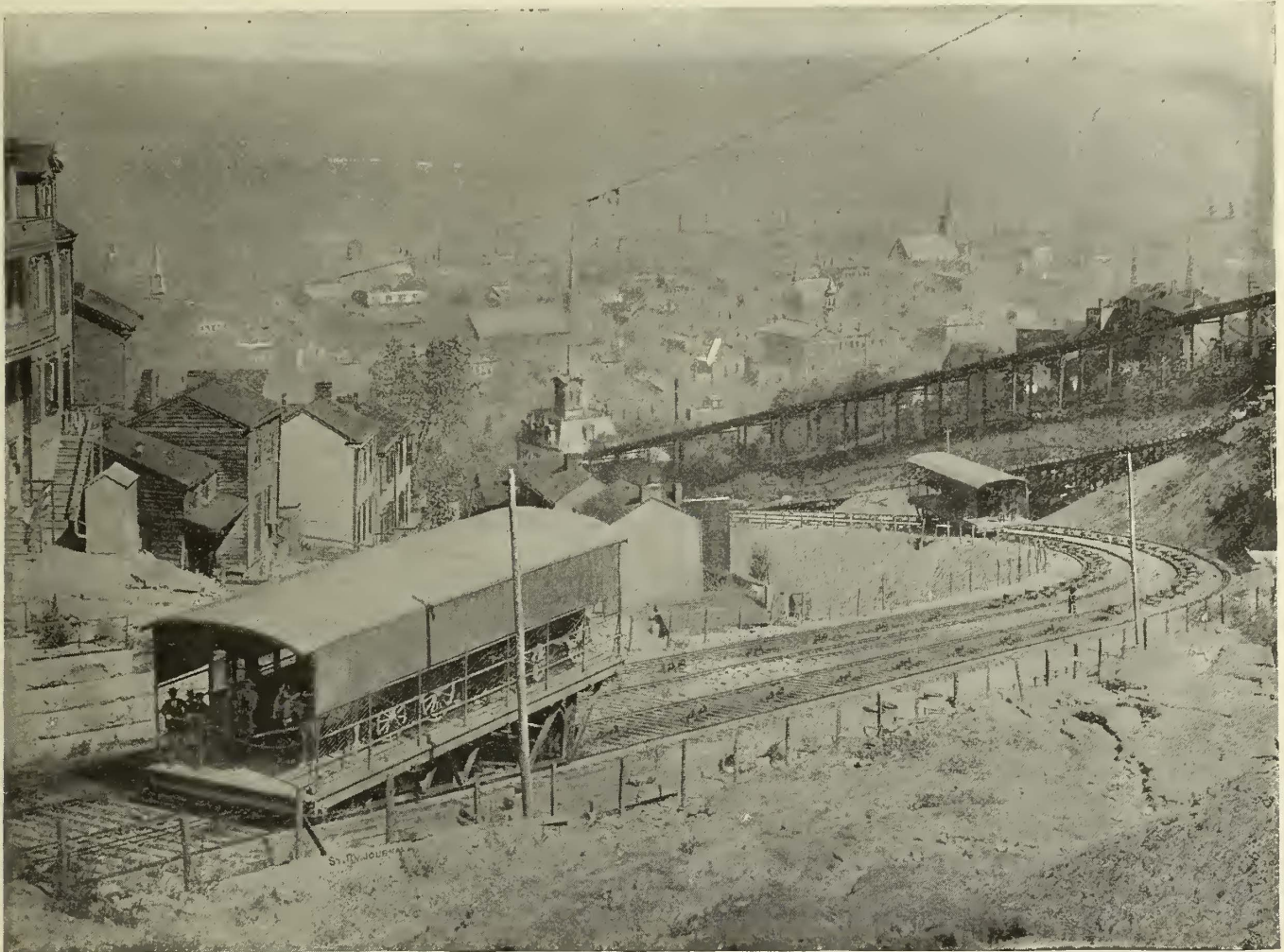
The "No Seat No Fare" Business.

A Very Sensible Article From the Chicago Evening Journal, December 6, 1891.

Evidently the proposed street car measure, which is called "no seat no fare," is the most impracticable of any that has been suggested as a cure for over crowded and too few cars.

Instead of remedying the evil, if it could be applied, it would make the evil greater. To prohibit the companies from carrying more than twenty-four passengers in a car would leave thousands and thousands without any means of transportation, if the cars should run less than a rod apart.

To establish a rule that street car doors should be closed when the seats are full and that no further stop-



KNOXVILLE INCLINE, PITTSBURGH, PA.

tion, contains among other things a full description of the inclined planes of Pittsburgh and Allegheny, Pa. One of the most interesting of these was the Knoxville incline which is illustrated in the accompanying engraving. This is located near the Mount Oliver incline which is shown in the background. This is the longest of the inclines, being 2,640 ft., in which distance it has a rise of 375 ft. The peculiarity of this construction, which differs from that of most inclines, is that the tracks make an eighteen degree curve for 350 ft. at a point about 1,000 ft. from the lower terminus. The driving ropes are carried around the curve on thirty-six inch pulleys which are located in each track. The cars are 16 x 47 ft. on a triangular truck and are designed to carry fifty tons or more. The fare is only one cent, and there is a very heavy travel both of foot passengers and wagons.

pages should be made to receive passengers, would create a riot at every street corner afterwards reached.

Uncomfortable and exasperating as it is to be compelled to stand up and hang on to a strap for a ride of two or three miles or more, it would create greater discomfort and exasperation if people should be prohibited from entering cars.

Men and women by thousands must get downtown by certain hours, and if there are no seats in the cars they must "stand it," so to speak, and make the best of it. They cannot wait, and must ride, seat or no seat.

There is another thing. Under such a regulation, if enforced, the cars would be crowded with standing passengers who would get on board for the mere purpose of securing a free ride. The "beats" would be in a majority of the passengers. They would more than overload the cars, and would make it more uncomfortable for paying passengers on the seats than it is at present with the greatest crowds.

No; this would be no cure. The only cure is for the

THE number of passengers carried on the Buffalo, (N. Y.) Street Railway during the year ending June 30, 1891, was 17,768,570.

street car corporations to use all the facilities that they have or can add to the present equipment of the lines, and then must come, or rather immediately should come, elevated roads.

Even then this vast surging mass of the population of Chicago, after all shall have been done that shall be possible, will find the discomforts of the "rush" hours too much for any but the most even tempers and the most patiently disposed.

There is one other source of relief that might be added. Let women who come downtown only for shopping purposes do so early in the day, and go home before the "rush" hours. They will find the stores less crowded as well as the street cars.

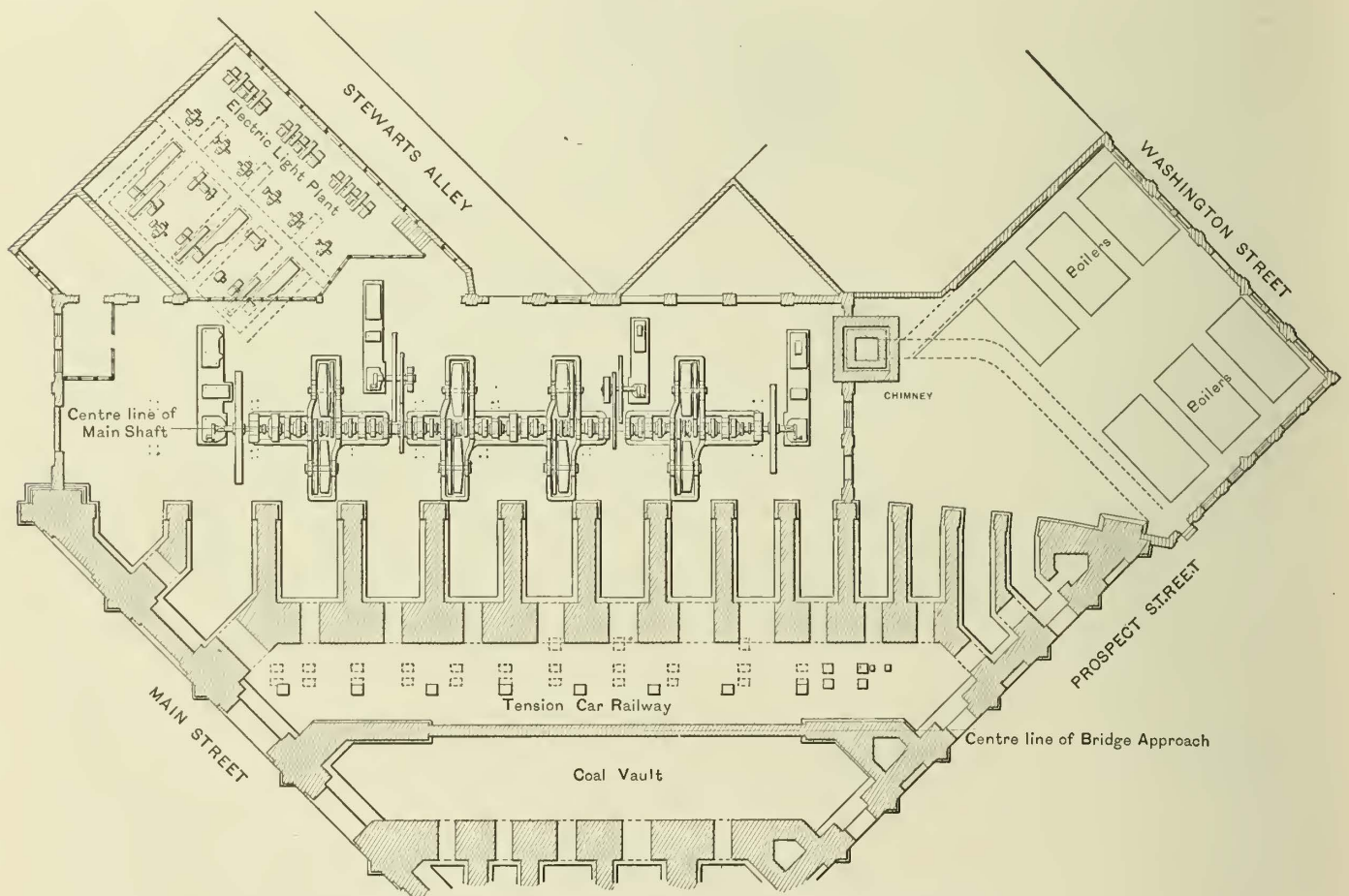
Favorable Testimony.

In conversation with Mr. H. A. Everett, formerly of Cleveland, now general manager of the street railway

good points of all the systems. In the meantime we are experimenting with a number of the more recently improved motors on the Cleveland lines for the purpose of satisfying ourselves as to their relative merits before deciding what system to employ on the Toronto lines. Among the motors which we shall try will be one of the Short single reduction motors, also one of the Westinghouse single reduction, and the Edison single reduction, the Wightman motor, and the motor manufactured by the Detroit Electrical Works."

Brooklyn Bridge Cable Power Plant.

The accompanying engraving illustrates the ground plan of the new power plant designed for operating the cables on the Brooklyn Bridge railway. The engine and boiler rooms have recently been enlarged, and the power equipment will be increased by the addition of one new engine and the erection of two sets of winding drums.



GROUND PLAN, CABLE POWER STATION—BROOKLYN BRIDGE.

lines of Toronto, Can., he stated that the great importance of electric traction lay in its possibilities, but no one could estimate these, for when a system was once established it required a constant outlay to keep up with the inevitable growth of the city and the increased traffic incident thereto, and that he knew of no electric lines in this country that had been operated long enough to determine when a halt could be called in the line of development. "When we first introduced electricity on our lines in Cleveland," said Mr. Everett, "we were operating sixteen cars, and it was estimated that the cost of changing to electric traction would be about \$40,000. We have already expended over \$450,000 and are now operating ninety cars. Notwithstanding the enormous sum that we have spent in experimenting with electricity on the East Cleveland lines, we would gladly do it all over again, if it were necessary, to secure the advantage of this method of traction. We have not decided what system we will adopt in Toronto; in fact, we think there is very little difference in the systems. Each of the prominent motors has some points that are better than others, and if it were possible we would be glad to employ a system embodying the

The new drums will be mounted on an extension of the main shaft of the present equipment which consists of the two drums, shown to the right of the plan. The drums will be driven by means of differential gearing, the same as the original drums, the device being the invention of Mr. G. Leverich, associate engineer of the Brooklyn Bridge. The tracks of the bridge railway are to be in duplicate, not, however, far enough apart for trains to pass, but the new rails will be laid about six inches from the rails of the present track. When completed with the new approaches, it is intended to operate two of the cables at the same time, while two are kept in reserve. Additional particulars of the new construction will be found in the annual report of the trustees printed in another column.

The Short Electric Railway Co. have just closed a large contract with the Atlanta & Chattahoochee Railway of Atlanta, Ga., and the plant will be installed immediately. The contract calls for the new Short single reduction motors, and the Short slow speed multipolar generators of 200 H. P. each.

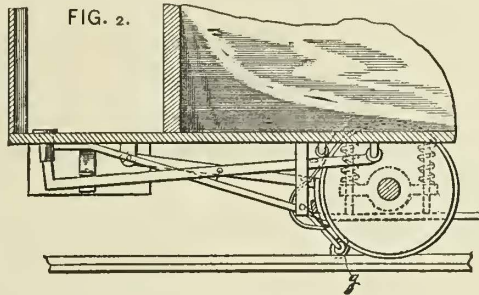
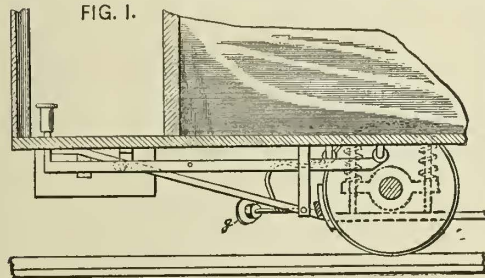
New Track Switch.

The accompanying illustrations show a device for operating a tongue track switch from the car, the invention of Jeremiah Young of Boston. For electric lines where there are no horses in advance of the car to move the tongue the advantages of a simple and effective method of switching which shall be under the control of the drivers, is apparent.

Fig. 1 shows a vertical longitudinal section of a portion of a car equipped with the device. A bracket is secured centrally to the bottom of the car directly in front of the wheel truck. Two laterally projecting rods, one of which only is shown, are swiveled at their ends in the bracket, in such position that their outer ends are in position to be directed into engagement with the track. These rods are provided on their outer ends with a roller having an annular flange or disk, which rests against the outer edge of the track when the rods are lowered.

Each roller is connected by a system of levers with a button on the front platform, so that each can be lowered

into position at the will of the operator. Its appearance when in this position is shown in Fig. 2.



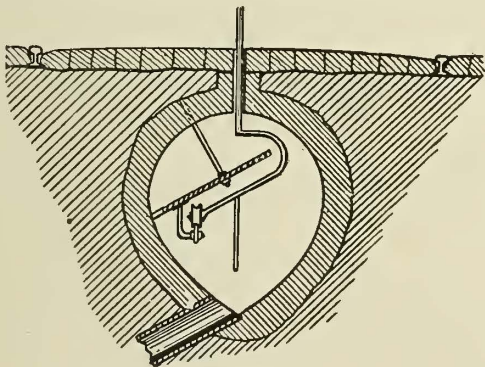
into position at the will of the operator. Its appearance when in this position is shown in Fig. 2.

The use of the device is then easily understood. For directing the car to a turnout on the left, the left hand button on the front platform is pressed down by the driver or motorman. This lowers the roller which engages the outer edge of the rail, as described, as near as possible to the point of contact between the wheel and rail. Thus the ordinary flange of the wheel is held closely against the inner face of the rail, and as it reaches the branch track it is caused to be directed therein instead of running straight on the main track.

As soon as the foot piece is freed it is forced upward by a spring and the roller is taken out of connection with the track.

An Electric Railway Conduit.

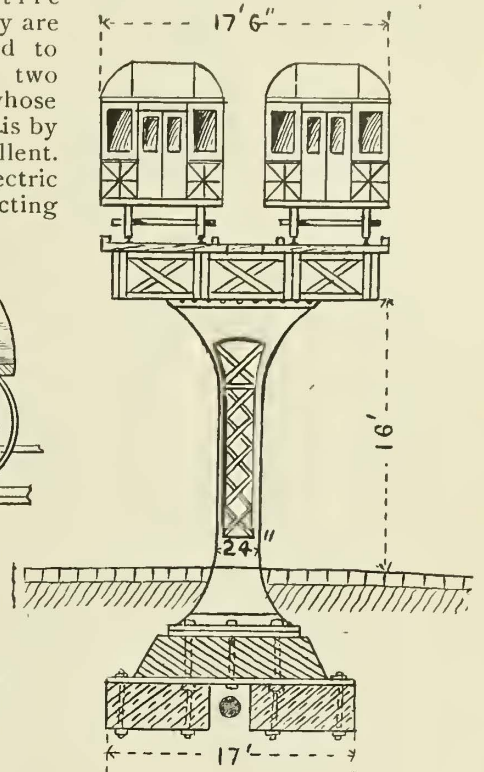
A new type of electric railway conduit, using an open slot, has been devised by S. D. Nesmith of Cleveland, O.,



a cross section of the device being shown in the accompanying engraving. As will be seen, the conducting wire is supported upon a short bracket, protected by and supported upon a metal plate extending longitudinally in the conduit and fixed at an angle of about forty-five degrees from the horizontal. The trolley arm or plow is of a peculiar shape, adapted to the conditions of the conduit, the main portion being curved so that it clears the metal plate, and at the same time, at its lower end, makes contact with the trolley wire by means of an ordinary trolley

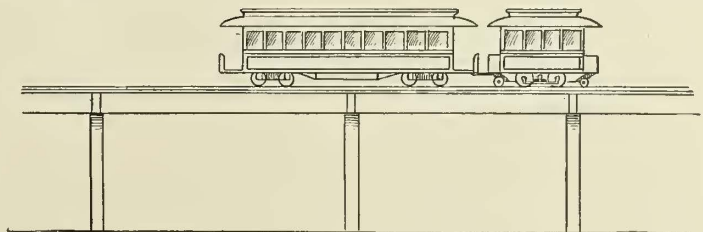
Chicago & Evanston Electric Railway.

The residents of Evanston, a suburb twelve miles north of Chicago, are greatly interested in the Chicago & Evanston Electric Railway Co. They are at present obliged to depend upon two steam railroads whose suburban service is by no means excellent. Should the electric railway connecting



Evanston with Chicago be constructed it would greatly enhance the value of the former as a place of residence. The projectors of the road are energetic. It is stated

that they have now secured the consents of property owners from Clybourne Avenue on the north side to Evanston, with the exception of about 1,500 ft. It is the intention of the company to build a surface road to Clybourne Avenue where an elevated structure will commence. This will pass over Hawthorne Avenue to Larrabee Street, a distance of about a mile and a half, and on Larrabee Street and Chicago Avenue to Kingsbury Street, and on the latter to Kinzie, thence to State and across the river, with the possibility of a loop through the courts between South Water and Randolph Streets. It is proposed to build the elevated structure on a single line of columns, which will be located in the

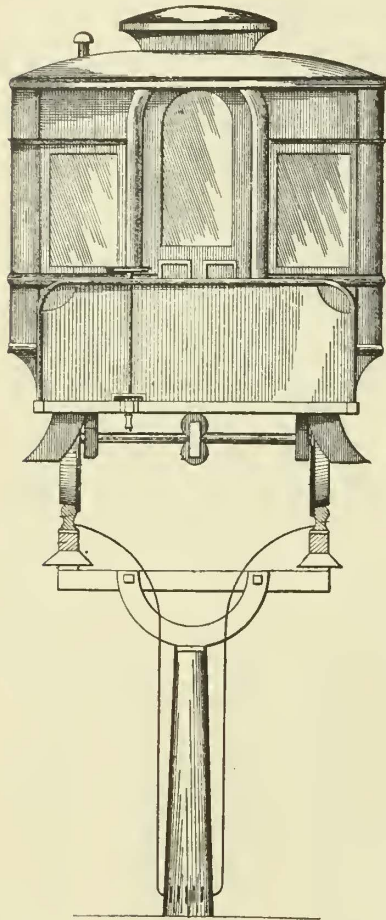


space between the surface tracks. These supporting columns will be placed every thirty-five feet. As soon as the required frontage is obtained, the company will ask for a franchise. When this privilege is granted, the Edison company will take charge of the construction of the railway.

THE Lindell Street Railway Co. of St. Louis are operating two Short gearless motors. The first trip was made November 25, and the electrical apparatus has been in constant use since that day, with the best possible results.

The Green Electric Railway Patents.

The Patent Office issued on December 15 two patents to George F. Green of Kalamazoo, Mich., covering inventions in electric railways, which, it is claimed, will have an important bearing on the electric railway interests of the country. The application for Mr. Green's



first patent (No. 465,407) was filed September 15, 1879, but owing, it is said, to its being prepared by himself and to his unfamiliarity with patent matters, it did not meet all the requirements of the Patent Office in regard to technical description, though the invention was pronounced patentable from the start.

For these and other reasons the application was rejected. But Green's claims, covering the broad matter, were persistently prosecuted by way of an appeal to the Supreme Court of the District of Columbia, and the latter tribunal overruled the Patent Office, thus securing to Green the claims for which he had been so long contending. An experimental railway, which is claimed to have been the first full sized electric railroad ever operated from a stationary source of electric energy and capable of carrying passengers, was built by

Green in 1878. But his invention was made long prior to this date, as shown by a small model of an electric railroad built and operated by him about the winter of 1874-75 for the purpose of exhibiting his invention to capitalists and demonstrating its practicability.

Fig. 1 is a reproduction of the drawing illustrating Green's first patent. The object of the invention, as stated by the patentee, is to operate cars readily and easily without the annoyance of carrying the source of energy by which the cars are propelled. To accomplish this Green states that independent conductors can be used, but that he prefers the rails be insulated, one rail of the track being connected with the positive pole of the source of electrical supply, the other being connected with the negative pole. The motor is carried on the car and supplied with electricity by metallic connections with the track, either through the wheels or otherwise. The fourth claim awarded by the patent is as follows:

The combination of a railway track, one or more stationary means of electric supply, electrical conductors extending from said means of electric supply along the lines of said track, and consisting wholly or in part of the rails thereof, moving along said track, rotating electro-dynamic motors fixed upon said vehicles for imparting motion thereto, and wheels supporting said vehicles upon the track, and also serving to maintain electrical continuous connection between said means of electric supply and said rotating motors, substantially as described.

In the second patent (No. 465,432) the application for which was filed May 15, 1886, the object of the patentee is to secure, with the system described in the former patent, a method of motor control. To accomplish this he places a pole-changing switch in circuit with the motor, so that the current in the latter can be reversed in direction by one movement of a lever. The first claim made in this patent is as follows:

The combination of one or more stationary sources of electric

current, a conducting circuit formed wholly or in part of an insulated line of rails of a railway track, a wheeled vehicle movable upon or along said line of rails, one or more rotating electric dynamic motors mounted upon said vehicle for propelling the same and included in said circuit of conductors, and a circuit controller placed on said vehicle and also included in said line of conductors, substantially as described.

Both of the patents described above have been assigned by the inventor to Oliver S. Kelly, of Springfield, O.

Wire Rope Dressing.

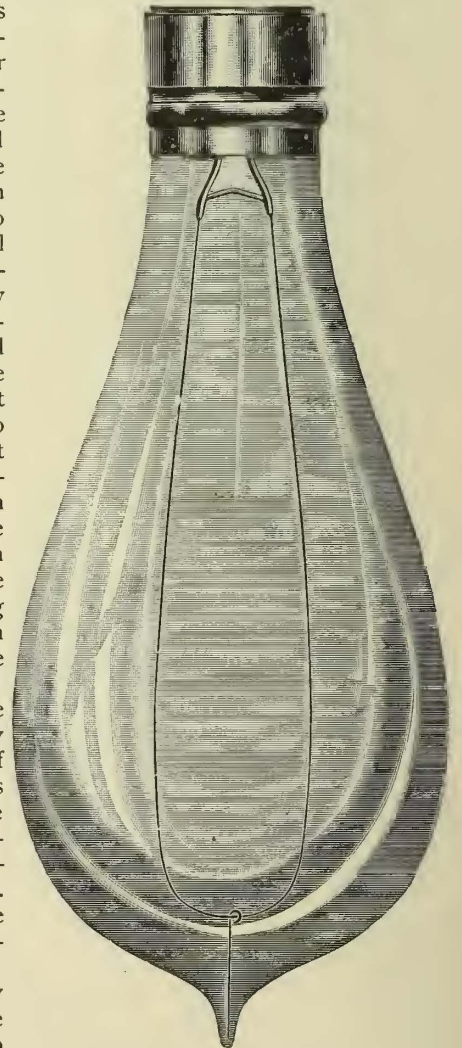
Cable railway managers who find it difficult to procure a satisfactory dressing for wire ropes will do well to follow the practice of the Third Avenue Railway Co., of New York. We are informed by Mr. F. L. Hart, mechanical engineer, that for the last six months they have been using for cable dressing on the Tenth Avenue and 125th Street cable lines a tar made by the Improved Pine Product Co., whose offices are at 5 and 7 White street, New York. This is distilled tar, free from moisture and acid and can be used pure without a mixture of lime or oil, and applied direct to the cable without being heated. The price per barrel is the same as for ordinary tar, and since the line began using it it requires about twelve barrels and two weeks' time to fill a cable, where formerly it required thirty barrels and an application during five or six weeks to get a rope in proper condition, and the action of the rope upon the driving drums is more satisfactory.

The Columbia Railway Incandescent Lamp.

An incandescent electric lamp is now being manufactured by the Columbia Incandescent Lamp Co., of St. Louis, Mo., which is especially constructed and adapted for use on electric railway circuits. The filament is anchored at the bottom of the lamp with platinum hooks, and is so made that it will stand quite a fluctuation in voltage. By this method the filament is strengthened at the point where breakage is most apt to occur, and is also stiffened throughout its length, preventing the destruction of the lamp by the carbon coming in contact with the glass and cracking the globe through the vibration of the car.

A number of these lamps are already in use upon many of electric railways throughout the country and are reported as giving excellent satisfaction. The lamps are made to fit all the standard sockets.

This company have had a large experience in lamp manufacture, and also supply commercial lamps for use in central stations and isolated plants. They claim for their lamp long life, high efficiency and full candle power, and that the lamp will maintain its candle power to the highest degree during its life, and that there is scarcely any discoloration of the bulb.



Return Circuit for Electric Street Railway Systems.

BY GEORGE K. WHEELER.

The above subject is one which has not received the careful attention it should have from electrical engineers and contractors or railway companies who have in operation or are about to install an electric railway system. It is the purpose of this paper to bring to the notice of such the importance that this part of the installation bears to the operation of any road commercially, satisfactorily and economically. The return circuit may be constructed so that the coal consumption will be largely in excess of that required to operate the road, and the writer regrets to say that a large number of roads are now operating with power house expenses frightfully in excess of what they should be, on account of unbalanced circuits.

The following are the different methods that have been and are now in use, with mention of their advantages and disadvantages: The first method, the oldest, is that of bonding the rails with a No. 4 bare, soft copper wire about thirty-six inches in length, having soldered on each end a copper rivet three-eighths of an inch in diameter. The manner of connecting is to drill a three-eighths inch hole in the rail about eighteen inches from the end, pass the rivet through the hole from the inside of the rail and head it down securely; in addition to this, the bond wires are connected together about every 500 ft. with a copper wire of same size as the bond wire, and all connections are carefully soldered.

The objection to this method is the great liability of poor connections, owing to the large number of soldered joints necessary to secure the rivets to the bond wires, and the liability of bond wires of this size breaking by reason of poor joints in track and by teams running on track where paving is not used, and the vibration of track causing the wire to break away from the rivet. Further, the carrying capacity in amperes of this circuit is only sufficient for small lines operating a limited number of cars.

The second method of construction only differs from the first by the use of iron instead of copper wire. This method has only one advantage over the others; that is, its low cost to install. It is, in the writer's opinion, the poorest kind of a return, and after it has been laid for a few months is but little better than the track itself, without bond wires. It is well known that the life of a No. 4 galvanized iron wire when suspended in the air, is about seven years, and its life when underground must be considerably less than this, on account of the great liability of corrosion. Bond wires of copper are used to obtain high conductivity at the joints of the rail, which cannot be obtained by means of the ordinary plates and bolts on account of the rust which will accumulate at these points; therefore it seems useless to construct the return circuit with iron wire, which has a conductivity considerably less than that of copper. The efficiency of this return is considerably reduced by reason of the rusting away of the wires where they are connected to the rails. Railway companies intending to equip electrically will do well to shun the wire return if low cost of operation and maintenance is desired.

The third method, one which has been generally used and has given good results in a number of cases, is to construct the return circuit in the same manner as in the first method, but in addition to this, use a No. 0 soft drawn, bare copper supplementary wire which is laid between the rails in the centre or on the side, as may be desired, and connect each of the bond wires to this wire, soldering all connections. But the same objections apply to this as in the first method, with the exception that it gives a much better return on account of the addition of the No. 0 wire. On some roads of great length where a large number of cars are used, it has been found necessary to run out track feeders in addition to the supplementary wire since the conducting capacity of the rails has not been and could not be fully utilized when No. 4 bond wires were used. Railway companies have often objected

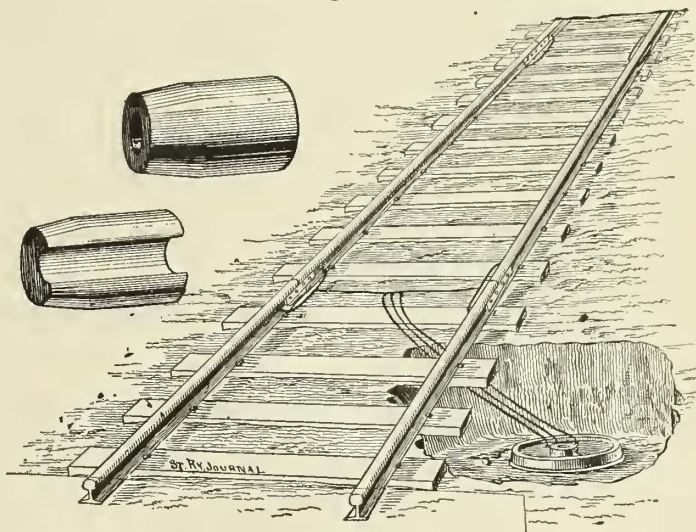
to using the supplementary wire on account of the increased cost of track construction, which is about \$300 per mile, and have preferred to put that amount of money into overhead feeder lines, so that in a great many cases this has been done, incurring a needless expenditure of money, though without benefiting the system one particle.

The writer has given considerable attention and study to this subject and has made a number of experiments on all forms of return circuits during the past few years, for the purpose of obtaining the most efficient method and one that could be more economically constructed than the third method, where the No. 0 supplementary wire is used, and for the past year has recommended the following form of construction, which may properly be called:

THE IDEAL RETURN CIRCUIT.

This circuit is constructed in the following manner:

Drill in the rails, about eighteen inches from each end, a hole nine-sixteenths of an inch in diameter with a twist drill, and connect to each rail a No. 0 soft drawn, bare copper bond wire by means of a channel pin of either pattern, illustrated at the right in the accompanying engraving. Placing the bond wire in the hole from the inside of the track and driving the channel pin in from the



outside, secures it firmly to the rail without the use of solder; this is a very decided advantage gained over other methods of bonding, as there is no possible chance of connections being corroded, as there is when solder is used. The cost of labor is also largely reduced as the connection can be made in a very short space of time. In addition to this, the rails are cross-connected every 300 ft., connection being made to the bond wires at these points by means of a copper wire, the same size as the bond wires. This method gives a large carrying capacity, the safe carrying capacity in copper being 260 amperes, in addition to the amount that must necessarily be carried by the rails. The cost of this, including all material and labor, is about \$300.00 per mile of single track, and as compared with the third method where supplementary No. 0 wire is used and which costs \$550.00 per mile of single track, a saving is made of \$250.00 per mile, and a much better return is obtained with less liability of breaking of bond wires and corrosion through poor soldering.

In addition to this, on roads over five miles in length, the writer recommends the following

EARTH RETURN.

This is constructed in the following manner and can be used in connection with any form of return circuit: Place an old car wheel deep enough in the soil between the tracks to reach moist earth, connecting the car wheel by means of channel pins to two or three No. 0 copper wires, and connecting the same to the bond wires at that point, and at the power station sink several car wheels in moist earth, the number to be determined by the number of wheels placed in the soil between the tracks, and connect the same by means of wires of sufficient size to the

negative side of the generators. This will, in addition to the rails and bond wires, give an earth return which will largely assist in the economical operation of any road, providing the roadbed is not constructed upon ledge rock. This form of construction has been used on several large roads and excellent results have been derived, the motor cars moving very quickly when the current is applied, at all times using a small amount of current, and greatly reducing the coal consumption at the power station.

On roads where track feeders are required, it is advisable also to install supplementary wires placed in the centre of track and connected to each bond wire. This is much more economical than constructing track feeders overhead and there is less liability of short circuiting the system.

RIVER RETURN.

Good results have been obtained by use of river returns in addition to the rail and earth returns, and they should be employed wherever possible. If a river runs adjacent to any point of track and the power house, it would be well, in addition to the rail and earth returns, to sink in the river bed old car wheels or metal plates, copper preferred, of sufficient area, and connect the same to the bond wires of the rails by means of No. 0 copper wires. A similar connection should also be made with plates or wheels at the power house and the same be connected to the negative poles of the generators.

On a number of roads which have been constructed the negative poles of the generators have been connected

been put into operation. They should be carefully inspected by the trackmen whenever possible, and a broken or defective bond wire can be readily discovered at night, as there will always be a flash at the wheels when the motor car is passing that point. Defective or broken bond wires should always be immediately repaired. There is always a marked decrease in the amount of current used in the operation of an electric railway during rainy weather; this is due to the fact that the moisture assists in making a perfect contact between the wheels and rails, and also allows the current to pass defective bond wires by way of the earth. A great many of the larger roads use a water tank car, which is arranged to allow a flow of water to run on both rails, this keeping the rails wet at all times. On these roads it has been found that considerably less power is required to operate, and that there is an entire absence of sparking at the wheels.

In conclusion, the writer would certainly advise all railway companies who equip electrically to be sure that they obtain the best possible return circuit, and one that will be ample and sufficient for their needs, and he would suggest to those who are at present operating electrically equipped roads that they increase the return circuits which they are now using by adding the earth return above referred to, and also the river return, whenever possible, and thus establish a marked reduction in expenses of operation and maintenance.

Notes from the Field.

Albany, N. Y.

For some time rumors have been industriously circulated, by parties hostile to electric traction, to the effect that the operation of electric railroads by the overhead system was not so great a success as has been claimed, owing to a greater depreciation in the appliances than had at first been anticipated, for which reason a number of roads had come to the conclusion that all that glitters is not gold, and were regretting that they had equipped their lines with this method of traction.

If there are still any sceptics in regard to the value of electric traction in situations that are favorable to this method they have but to visit Albany, N. Y., and study the operation of the lines of the Albany Railway Co., which are now all operated by the Thomson-Houston overhead system, when we are quite sure, all their doubts will be removed.

Having spent some time in Albany recently, we are able to give our readers reliable information in regard to the operation of these lines. Mr. John W. McNamara, general manager of the Albany Railway Co., in answer to our questions, replied that, had they to start over again to change from horse power to electricity, in the light of experience gained after eighteen months of practical operation, they would do just as they have done, taking advantage, of course, of the improvements which have since been made in motors and electrical appliances; that the lines were being operated with better success and with far less annoyance from electrical failures than they anticipated when they decided to adopt electric traction; that the operations of the road improve with age, and that it requires less power to operate the same number of cars than when the lines were first equipped, and that the lines were being operated for sixty per cent. of the gross receipts, not a single passenger having been injured since the lines began to be operated with electric power and no serious injury having been done to pedestrians. There had, however, been a few more accidents to vehicles, with which the motors had come in contact, than formerly. Owing to the method employed of ground return, known as the Sabold system, there was no interference whatever with the telephone service; the service had proved acceptable to the patrons, and travel had increased to such an extent that it had become necessary to add ten new eighteen foot cars to the equipment.

There are so many interesting features connected with the operation of these lines that are worthy of imitation that we feel justified in mentioning them in detail,



NO. 0 COPPER WIRES EATEN AWAY BY ELECTROLYSIS.



NO. 0 COPPER WIRE IN PERFECT CONDITION.

to the overhead line, making the rails positive, and the current has passed from the supplementary wire (if used) and bond wires to rails, from rails to wheels, through wheels to motor, through motor to overhead line and back to the generators at the power station. This is bad practice and will invariably work great injury to any system in a very short time on account of electrolysis, which occurs by reason of the positive current passing from the copper supplementary or bond wires to the iron rails, causing the copper to be rapidly eaten away, making poor connections, obliging the generators at the station to work at all times under a heavy load and increasing the coal consumption and the liability of injury to the apparatus. The writer has some samples of No. 0 wire which were in the oil but a few months, with the positive poles of generators connected to the rails, which are in a very bad condition, being almost entirely eaten away. They were laid in soil that was not affected by any gases or salt water, and the action can only be due to electrolysis. All systems, in the writer's opinion, should be connected with the positive pole of the generator of the overhead line, and he believes that this is to-day the standard practice and conformed to by all engineers and contractors.

There is one thing more that is equally as important as the installation of the return circuit, and that is, the attention that bond wires should receive after a road has

although the power station and general equipment has been fully illustrated and described in the June, 1890, issue of the STREET RAILWAY JOURNAL.

Five separate lines are now operated from a central power station. These are known as the State Street line, which runs to West Albany, the Pearl Street line, Hamilton Street line, Clinton Avenue line, and Madison Avenue and Park Street line. The State Street line was the first to be electrically equipped, and was put in operation in April, 1890. Owing to the physical characteristics of the route, it is one of the most interesting in the country. The grade on State Street from Pearl Street to the Capitol, is eight per cent. From State Street to Washington Avenue the line makes a compound curve, a portion of the way on a four per cent. grade, and continues past the Capitol on Washington Street. A branch has recently been added to the State Street line, leaving the main line at the foot of Washington Avenue and passing through Steuben Street to Broadway, terminating directly opposite the Union Depot. This is a single track line, with two turn-outs. The whole route from Pearl Street to Eagle Street is on a uniform grade of eight per cent.

The speed of the cars over the grade on State Street is five miles per hour, and the speed on the remainder of the road varies from eight to twelve miles. It is interesting to note that before the adoption of electricity, steam motors were tried on the State Street hill, and, when the track was in good condition, were able to ascend the grade, but were obliged to continue the ascent without stopping. Electric motors start readily from any point and make the ascent without difficulty when the cars are crowded with passengers. It is necessary, however, to keep the track thoroughly sanded, a requirement which is accomplished both by the use of sandboxes on the cars and by having a man stationed on the hill, whose duty it is to apply the sand to the rails at frequent intervals; this he does by means of an ordinary watering pot with a long spout. Sand is applied to both rails of the down track, but to only one rail of the up track, the other being left clean to provide for proper electrical contact. The trucks of the cars on the State Street line are equipped with the Flood car starter, or dog, which we have previously illustrated, and which is employed to prevent the cars from running backwards when it is necessary to stop on a steep grade. At a point just above Pearl Street where the regular stop is made to take on passengers, every other row of paving blocks between the track is left an inch or two higher than the ordinary level to provide a firm footing against which the dog may rest. The dog is under the control of the conductor, and is let down when the grades are approached and lifted free from the track when passing over level portions. The use of this device is highly commended by the management. The trucks are also provided with slipper or track brakes, which are employed in connection with the wheel brakes when the rails are slippery. There are conditions of the track, however, when it is found impossible to stop the cars even with the slipper brakes, but by their use the speed is reduced below the danger limit.

The cars composing the original electrical equipment were manufactured by the Gilbert Car Manufacturing Co. of Troy, and give every appearance of standing up well under the severe duty imposed upon them. They are kept scrupulously clean and are not disfigured by advertisements. The cars are mounted on the Manier non-oscillating truck, and the journals have the Meneely roller bearings. These bearings give excellent satisfaction and very materially reduce the power required for hauling the cars.

The ten new cars before mentioned were built by the same company, but are mounted on the Taylor truck, which was illustrated and described in the November, 1891, issue of this paper. These trucks are equipped with the Meneely roller bearings, and will be provided with a slipper brake of a new design and will be equipped with the Lewis & Fowler sandboxes and with the Flood car starter. The electrical equipment consists of two fifteen H. P. Thomson-Houston single reduction water-proof motors. The striking peculiarities of the Taylor truck are that they are provided with elliptical springs in place of the spiral

springs usually employed. On each journal box are placed half springs supported by side bars, and at each corner of the frame full fourfold elliptical springs are placed which support the body of the car. The car is attached to the frame in such a manner as to positively prevent the body from tilting or rocking. The trucks, without the motors, weigh about 3,600 lbs.

The new cars, with the exception of being longer by two feet, are of the same style and finish as the former equipment, being painted in straw color or light buff, with the main panel of claret color. The window frames are of mahogany, and the headings are of quartered oak artistically decorated.

The overhead construction of the Albany lines, as we have before noted, was done in a thorough and substantial manner, the poles being of the Hilton type and the trolley of No. 6 copper wire.

The experience of the Albany Railway with their tracks has been an interesting one, and their experiments will prove valuable to the railway world generally. The metallic construction which was employed on a portion of their lines proved inadequate for electrical traction and, with the exception of two miles, has been replaced with the girder rail. About two miles of the metallic system has been relaid on cast-iron chairs. On State Street and some other portions of the line the Lewis & Fowler girder rail is employed, and so far this rail is standing up splendidly under the traffic and gives promise of very long life. On other portions the Johnson girder, with the standard joint, has been employed and is also giving excellent satisfaction.

The company will extend their Greenbush line in the spring, and will build about four miles of new track on which it is intended to place the girder rail upon stringer construction, after the method employed in Boston. In case, however, this construction does not prove to be durable, as there is strong probability that it will not, a different construction may be adopted.

In discussing with the general manager the question of rails and joints, he claimed that it would require at least a year of service to determine whether any rail or joint would be durable under electric traction; that several kinds of rails tried had given satisfaction for six or eight months, and after that time had broken down.

The power station of the Albany system is located on Pearl Street, near Third Avenue, about 500 ft. from the river and beside the railroad track, so that coal is delivered from a siding directly into the yard adjoining the power house. The power equipment, which we have before described, consists of five Babcock & Wilcox boilers of 125 H. P. each, and three compound, McIntosh & Seymour high speed engines of 250 H. P. each. Originally each engine was designed to drive two Thomson-Houston eighty H. P. generators, to which they were connected by direct belting; but two of them are now driving six generators, three being coupled to each engine, and the third engine is now arranged to drive four generators, the shaft being equipped with three fly-wheels. The engines make 200 revolutions per minute and the armatures of the generators 900 revolutions. It requires but eight and a half tons of ordinary buckwheat coal per day to operate the entire twenty-six cars which are now running.

The water which is drawn from the river is purified by a Hyatt filter and fed from a National heater. Half hour readings of the appliances in the power station are made, and a daily report is made to the general manager. Ordinarily the maximum power required to operate the twenty-six cars now employed is 400 H. P., or about 16 H. P. per car, while the average power required does not exceed 250 H. P. Owing to the increased speed of the electric cars four cars handle the traffic on some of the lines where formerly seven horse cars were required. The increase of traffic on the State Street line for the first year under electric traction was 365,963 passengers over the last year's operations with horse cars. The fare on the State Street and other hill lines is six cents or twenty tickets for \$1. On Pearl street—a level line—the regular fare is five cents. No transfers are given.

In reply to our question, Mr. McNamara stated that

the cost for building one mile of straight double track similar to the Albany construction, including the paving and overhead equipment, would be about \$18,500, not including the power equipment or rolling stock.

Troy, N. Y.

The electric lines of Troy, which now operate over eighteen miles of track (seven more to be put in operation in the spring) with thirty-five cars, have a somewhat earlier history than the Albany lines, having been running about two and a quarter years. Three of the cars are equipped with Thomson-Houston and the balance with Edison motors.

Mr. Charles Cleminshaw, president of the company, in speaking of the success of electric traction, repeated substantially what we have quoted above from the remarks of the general manager of the Albany lines, to the effect that the Troy company would repeat their experience, were it necessary, and under no circumstances would they go back to horses, and further, that the patrons of the line would not submit to it were such a movement proposed.

The Troy company are still operating four and a half miles of road by horse power, and the operating expenses of the two methods of traction furnish a striking proof of the advantage of electric traction, the cost of operating expenses per car mile, being less with electricity than with horse power. In reply to our question as to the system he would recommend a new line to adopt, were his advice sought, Mr. Cleminshaw stated he would not attempt to say, until he had made a more careful test of some of the new motors recently put upon the market, but that companies now contemplating electric traction would have a great advantage over the pioneers, owing to the reduction of price of electric appliances, and that the Troy equipment could now be duplicated for much less than the original cost. In view of increasing the equipment with new motors, a car equipped with the Edison single reduction motor is now being operated experimentally by the company.

While pleased with the success of electric traction, the most serious question connected with the operation of electric lines is that relating to a proper rail and joint. On being asked what type of rail and joint he would recommend, Mr. Cleminshaw stated that he could not give any advice, that they had tried four kinds of construction, and with none of them were they satisfied, and that they were designing a rail and joint that would be different from anything now in the market, and with which they would experiment during the coming season. The best success so far had been had with the Johnson sixty-three pound girder rail and the new standard joint made by the same company. They were intending to equip an additional track with the same construction with ties only eighteen inches apart, from which they expected better results than from anything heretofore tried. Incidentally it was mentioned that on a single track where the motors run in both directions the joints stand up much better than when the cars run continuously in one direction. The grades on the Troy lines are not severe, the heaviest being an eight and a half per cent. grade 500 ft. in length.

The poles employed for supporting the overhead equipment on the Troy lines were manufactured by the Syracuse Tube Works and are giving excellent satisfaction. The power equipment of these lines has recently been increased by the erection of a new power house on Front Street, near the river, diagonally across from the car house, in which has been installed a 425 H. P. Greene engine, manufactured by the Providence Steam Engine Co., which is belted direct to two 212 H. P. Edison generators of the latest improved type, which are illustrated on page 33. The belts, which are twenty-four inches wide and fifty feet long, from centre to centre, were manufactured by Barnum Bros., Co., of Troy, N. Y. The steam equipment consists of two batteries of Babcock & Wilcox boilers of 186 H. P. each, together with the usual equipment of pumps, filters and heaters. Foundations are

laid beside those in use, for duplicating the entire equipment. The switchboard is of slate, and provided with the very latest electrical switches and appliances, sufficient for ten generators. Water is drawn from the Hudson River, and coal is hoisted from boats to coal sheds alongside the boiler house.

The original power equipment, situated in Lansingburgh, four miles from the city, consists of one 400 H. P. Greene condensing engine, which is belted direct to three No. 32 Edison dynamos, and two 150 H. P. Corliss condensing engines, which transmit power through a counter-shaft to three No. 32 Edison generators. There are also three 500 H. P. Babcock & Wilcox boilers.

The entire system of electric lines is divided into five sections, with such arrangement of independent feeders, cut-out boxes, etc., from both power stations, that not only can the entire system be operated from either power station, but any section can be instantly cut out without affecting any other section.

Correspondence.

Communications on all subjects of interest to street railway managers are solicited. Names of correspondents may be withheld from publication if desired, but must be known to the editors. The correspondent alone is responsible for his statements and opinions, not the editors.

Advantages of Splicing Cars.

LINDELL RAILWAY CO.,

ST. LOUIS, December 12, 1891.

EDITORS STREET RAILWAY JOURNAL:—

Replying to your communication of 6th inst. relative to the advantages of splicing cars, in which you ask the following questions:

1st. What is the economy of building long car from two short cars?

2d. What is the cost of new eight wheel car?

3d. What is the estimated value of long car built of two short cars?

4th. What is the cost of reconstructing one long car from two short cars?

5th. Under what condition would you favor selling old cars and buy new, rather than rebuild into long cars?

I hereby submit answers to each question, as follows:

1st. On all roads where travel justifies the operation of trail cars the long car is the most economical, and for such roads as have a full equipment of twelve, fourteen or sixteen foot cars, either trail or motor cars, the advantage of operating a long car, as compared with a motor car and trailer, as hereinafter mentioned, is certainly in favor of the former.

2d. New eight wheel cars, about forty feet in length, can be purchased at from \$1,800 to \$3,000, according to the design and finish.

3d. The estimated value of long cars built from two short ones depends largely on the estimated value of the two short ones, before such alteration is made, and the amount expended in finishing the same where said cars are joined. If properly constructed, framed and joined it would unquestionably increase the life of the two cars so rebuilt at least fifty per cent., as it dispenses with jerking, incident to the operation of trail cars, which is alike injurious to framing of motor and trail car, not to mention damage to platforms and drawbars. The long car mounted on double trucks also eliminates that rolling, rocking motion noticeable on short cars with single truck, and which is damaging to the entire framework of car.

4th. The cost of reconstructing two short cars into one long car depends entirely on the length of the former and the length required for the latter, also on the general design and finish. The writer has just completed two long cars, such as were illustrated in the October issue of the STREET RAILWAY JOURNAL, each forty-four feet long, rebuilt from sixteen foot cars, as follows:

From each sixteen foot car we took the hood and platform from one end and placed the said ends facing, allowing a space of four feet. We then connected the tops with an iron framing properly bolted to each car,

building an iron or wood transom at opposite ends for the pivotal truck, and connecting thereto iron or steel "I" beams, or long sills properly trussed. This completes the framing. The space between the two cars, known as a vestibule, is finished in accordance with the general appearance of the cars, and equipped with hinged doors and sliding vestibule seat, as well as a reversible step.

The estimated cost of the change is as follows:

Framing, including all iron and wood work, and labor of same.....	\$125.00
Reversible step.....	30.00
Doors, ceiling, roof, floor and seat of vestibule, including labor.....	85.00
Painting and varnishing vestibule to match balance of car.....	10.00
Total.....	\$250.00

For each long car so built there are two platforms, two hoods, two draw-bars, two brake staffs two handles, two bells and one register not used, estimated at fifty dollars, all of which should be securely stored away for repairs and renewals at each end of long car, leaving the net cost of the above charge, exclusive of trucks, \$200.

A car rebuilt in this manner, in operation by the Lindell Railway Co., of St. Louis, has been in constant service for upwards of four months, carrying on one load 138 passengers, besides motorman and conductor, and, being repainted, has the general appearance of a new car.

5th. No short car, twelve, fourteen or sixteen feet in length, having sound framing, should be disposed of by sale and replaced with new long cars when they can be readily and cheaply rebuilt into commodious long cars at a trifling cost and be made to give years of service.

Two twelve foot cars, with four foot vestibule, would make one long car thirty-six feet long, including platforms.

Two fourteen foot cars, with four foot vestibule, would make one long car forty foot long, including platforms.

Two sixteen foot cars, with four foot vestibule, would make one long car forty-four feet long, including platforms.

We do not find the latter too long, for it must be remembered two sixteen foot cars, coupled together with draw-bars, are forty-nine feet long.

The following are some of the many advantages in favor of the operation of long cars, as compared with short car and trailer attached:

- 1st. They dispense with one conductor.
- 2d. The load being all on motor trucks, they give greater adhesion to the rail, and consequently require less power.
- 3d. The brake question is solved, for it has been a source of much annoyance to railway managers how to brake the trail car.
- 5th. From this cause, and the fact that passengers will insist on getting on and off the front platform of the trail car, over seventy-five per cent. of accidents are due to operation of trail cars.
- 6th. The car repair account is decreased very materially, incident to the decrease in cars and parts.
- 7th. When license is assessed on cars, this charge is reduced fifty per cent.
- 8th. One register only is required.
- 9th. Cars with double trucks ride much easier than single truck cars.
- 10th. With the vestibule and side entrance, experience shows that passengers are as readily discharged as though riding in two separate cars.
- 11th. The wheel base being much shorter, curves are more easily rounded.
- 12th. Long cars are better adapted for crowded thoroughfares and heavy travel than motor cars with trailers, because they require less room and are more easily controlled.
- 13th. Passengers like them better.
- 14th. One car may be made a smoking apartment without interfering with passengers in the other.

15th. One part may be built open, the other closed.
16th. Passengers may pass from car to car without danger.

17th. Absolute freedom from danger of being run over by rear trucks is secured to passengers.

Yours truly,
G. W. BAUMHOFF.

WEST END STREET RAILWAY,
BOSTON, December 5, 1891.

EDITORS STREET RAILWAY JOURNAL:—

Yours of December 3 received, requesting that I give you my opinion regarding the economy and also practicability of splicing long cars from two short cars, and also the difference in cost of the new eight wheel cars, compared with the spliced cars.

To begin with, I would say it is a difficult matter to now dispose of any of our old sixteen foot horse cars. If they are ten or twelve years old people do not want them, but they are willing to buy a young car, say, three to five years old, and pay a good price for it. The best price we got for a sixteen foot horsecar, which was thrown out of service on a particular line by the introduction of electricity, was \$800. These we consider our best cars, run only a few years, built by Jones and made up in the best style. We do not take a car of this kind for splicing, for the simple reason that the value of the two horse cars would be \$1,600; cost of splicing, \$450, making a total of \$2,050 as the cost of the large car. What we do is to take our oldest cars, for which we can get but \$300 for the body. The first cost of two bodies will then be \$600; splicing, \$450, or a total of \$1,050.

The cost of the new cars, such as we have put on of late, is about \$1,600 or \$1,650, according to style and finish of the car. This makes a saving in equipment of about \$600. I wish to emphasize the fact that the cars are practically just as good for our business, earn as much money and ride as well, though they, perhaps, do not look as well; otherwise they fill the bill admirably. Our method of splicing is to take two sixteen foot cars and keep as near to twenty-five feet for length of body as may consistently be done, being guided by the number of windows. The cars, also, must be of the same pattern to an eighth of an inch, made from same templets when first built. We were unfortunate enough to build over a couple of cars, one of which was one-quarter inch wider in the dome and one-half inch higher than the other, and this made some trouble. These things have to be looked into very sharply before starting in to do any of this kind of work.

My advice to companies desiring to undertake this splicing is, that it depends entirely upon whether they can dispose of their cars. If they have only one, two, three, a half dozen or a dozen cars, I would say sell them, if possible, at almost any figure; but where a company has four or five hundred cars to dispose of, the question presents another aspect, and the most economical method is, do as we have done—splice.

Yours truly,
L. PFINGST,
Master Mechanic.

Street Railways and the World's Fair.

The main part of the strictly street railway exhibit at the World's Fair will be located in the Transportation Building. Here will be illustrated all means for conveying passengers and freight from one point to another. Of course many other buildings will contain displays of special interest to street railway men. In the Electricity Building, for example, will be located the exhibits of electrical apparatus for railways. The electric generating station in Machinery Hall will be a marvel in its way, as its capacity will be at least treble that of the similar department at the Paris Exposition. The work on the Transportation Building is proceeding rapidly. Mr. Willard A. Smith, chief of the Department of Transportation, says those interested in street railway work should now begin to consider how much space they desire, and how they wish to have it divided.

The Short Gearless Motor.

The Short Electric Railway Co. of Cleveland, O., is working its shops day and night on a heavy factory order for gearless and single reduction motors. The first large road to be equipped with the single reduction motors will be the Trenton Passenger Railway Co. of Trenton, N. J., work upon which is now progressing very rapidly, with the expectation that the road will be in operation on or about February 1. The first gearless motors of the final type will go to Albany, Washington, Louisville, Indianapolis, Rochester, St. Louis, Chicago, Cleveland, Denver, Houston, Brooklyn and elsewhere, in filling large contracts already secured by the Short company.

Although the Short company had a commercially successful gearless motor as early as last July and could have made shipments in quantities at that time, it foresaw that the financial situation would be such that very few large contracts would be closed before fall, and therefore determined to complete all experiments upon its gearless motor before sending it out in large numbers. The wisdom of this course has been justified, and the "Perfect" gearless is now not only the simplest but the most economical motor on the market. The magnetic circuit has been greatly improved by imbedding the armature coils entirely in the armature core, and extending the pole pieces so as to "present" at the top as well as at the sides of the armature. The armature has also been cross connected so that the brushes are both on top and extremely easy of access. The frame has been made rectangular instead of circular as before, so that it can now be easily placed on a thirty-three inch wheel with four inches clearance over the track. The method of connection between the hollow armature shaft and the truck has also been simplified. It will be remembered that the original plan provided a spring connection between a disk keyed to the hollow shaft and the car wheels. The second method was to do away with the springs, keying a three legged spider to the hollow shaft and providing wheels with special lugs cast on their spokes. This, while an extremely simple arrangement, had the disadvantage of calling for special wheels. The final method now adopted is to key a disk directly to the car axle close to the end of the hollow armature shaft, upon the latter being placed a two legged spider connecting with the disk through flexible rubber bushings, the car being driven both ways upon the same side.

It is interesting to note the development of great manufacturing corporations in the electrical field. Two years ago the Short Electric Railway Company was hardly known outside of a limited circle of believing friends. Its past reputation for never failing success is high, and it may also be noted that it has rarely failed to start a road successfully and without a hitch.

NOTES ON THE SHORT SYSTEM.

At Battle Creek, Mich., the Short Electric Railway Co. have installed an electric railway which is a model of completeness and careful workmanship. The line was opened for traffic late in November last and has an equipment of six electric cars, each equipped with two Short standard, double reduction motors. The cars were furnished by the St. Louis Car Co. At the power station are two 100 H. P. dynamos of the standard Short pattern. Both rolling stock and generating station are doing excellent work.

The Jamestown Street Railway Co., of Jamestown, N. Y., although one of the most difficult roads in the country to operate, is still one of the most successful. It has just purchased from the Short Electric Railway Co. a large amount of additional apparatus for its spring necessities, which will include, by the way, one of the finest private cars yet built, which will be equipped with the Short single reduction motors. The station is to be largely increased, and the Short 200 H. P. multipolar generators are to be used.

Personal.

Mr. S. S. Leonard of the Hill Clutch Works paid us a visit during December.

Mr. F. L. Hart, mechanical engineer of the Tenth Avenue, New York, Cable Railway, called at our office recently.

Mr. H. A. Everett, general manager of the Toronto (Can.), Street Railway Co., was a welcome visitor at our office one day last month.

Mr. Alexander von Babo, representing the firm of Siemens & Halske of Berlin, Germany, has opened an office in the Times Building, New York City.

Mr. E. J. Wessels has been appointed in charge of the New York City office of the Short Electric Railway Co. of Cleveland. Mr. Wessels was formerly of E. J. Wessels & Co., who own and operate the Wessels line of steamers between Jamaica and New York. He has had a wide business experience both at home and abroad.

Mr. W. H. Eckert has been appointed general agent for the sale of Kerite insulated wires and cables, *vice* Mr. Geo. B. Prescott, Jr., who has resigned on account of ill health. Mr. Eckert has for a number of years been connected with the Metropolitan Telegraph & Telephone Co. of New York, and is well known among the electrical fraternity.

Mr. Julius Meyer recently resigned his position as chief engineer of the Milwaukee Electric Railway Co., and will for the present be connected with the New York office of the Edison General Electric Co. Under Mr. Meyer's supervision over forty miles of track on the Milwaukee lines have been reconstructed for electric traction since July last. The new construction consist of seven inch girder rails spiked directly to the cross ties and connected at the joints with six bolt fish plates, the bolt holes in the plates being punched staggered.

Mr. C. D. Wyman, vice-president of the Central Park, North & East River Railway Co., called at our office during the month. In conversation Mr. Wyman stated that when he found a suggestion in our paper relative to a change or improvement in service, he usually called the foreman of the department, to which the improvement related, to his office, read the article to him, and discussed the matter with him, and when it was thought best directed that he should put the suggestion in practice.

Mr. J. S. Sloan and Mr. D. S. Caylor of the J. S. Sloan Co., dealers in heavy machinery of 42 Rue du Louvre, Paris, France, have been spending some time in this country inspecting rapid transit systems, and have made arrangements with the Short Electric Railway Co., of Cleveland, O., and also with the Walker Manufacturing Co. of that city to represent their interests abroad, and act as agents for introducing such American appliances as relate to electric and cable roads. These gentlemen sailed on their return voyage on the 26th of December, but before sailing gave us the pleasure of making their acquaintance at our office.

Mr. H. H. Littell, general manager of the Buffalo Railway Co., following his usual custom when in New York, paid the JOURNAL a visit last month. In conversation Mr. Littell confirms what has been said in an interview in another column of the rapid development of the street railroad business following the introduction of electric traction. On one of the Buffalo lines which was opened with twelve cars twenty-five are now being operated, and if they had them thirty-five could be filled during the rush hours of morning and evening. A good deal of controversy is going on in Buffalo between the railway company and the City Council over the application of the former to change the franchise of the Crosstown Line which was originally started as an opposition line, but which is now under the management of the Buffalo Railway Co. The original contract provided for paying into the city treasury eleven and three-quarters per cent. of the gross receipts, and the present company finding it impossible to operate advantageously under this requirement, has asked to have the rate reduced to three per cent.

Obituary.

Louis de Bebian, president of the Christopher & Tenth Street Railway Co. of New York, and one of the best known of New York's French residents, died of heart disease at his home, No. 165 West Fifty-seventh street last month. Mr. De Bebian was born at Guadeloupe, West Indies, in 1831, and came to New York when fifteen years old. He was a man of exceptional energy and besides his connection with the Christopher & Tenth Street company, was a director in various banks, gas, insurance and trust companies, and a member of the Chamber of Commerce, as well as being identified with a number of charitable and social organizations. Mr. de Bebian was one of the most active workers for the success of the French exhibit at the Centennial Exposition in 1876, and was treasurer of the American Committee on the Bartholdi Statue. He leaves one daughter.

A Testimonial.

At the last meeting of the executive committee of the National Electric Light Association, a very complimentary and deserved resolution was unanimously passed thanking Mr. John Carroll, of the Eugene F. Phillips Electrical Works, of Montreal, Can., for his untiring and eminently successful labors in connection with the reception of the Association during its convention at Montreal. These resolutions were ordered engrossed and presented to the above mentioned gentleman.

English Electric Railways.

The outlook for electric railways in England at present seems to be very bright. The Brush company are reported to have some very important and valuable contracts on hand, among which is the application of electric traction to the Liverpool Overhead Railway and the South Staffordshire Tramway Co. This corporation and its affiliated company, the Electric Traction Co., seem to be taking a leading position in the immense field which is opening up for electric traction, and some of the most important provincial tramways, notably the Glasgow Tramway, and in close negotiation for the application to their systems.

A Reorganized Car Company.

The Northern Car Co. of Minneapolis have recently been reorganized, and their capital stock increased to \$250,000 in order to accommodate the many orders of which the company are constantly in receipt. The new officers of the company are: President, C. P. Jones; vice-president, W. E. Steele; treasurer and general manager, D. M. Gilmore, who was with the Gilmore Furniture Co. of Minneapolis for seventeen years, and secretary, George P. Stearns. The superintendent is C. B. Manier, who was for three years with the Gilbert car company of Troy, N. Y., as workman, general foreman and superintendent.

At the location of the factory at Robbinsdale there are at present three buildings, each 60×150 ft., to which will be added immediately a paint shop 75×100 ft. On the pay rolls of the works are 200 names, and the capacity of the works at present is one car per day.

The impetus given to the car manufacturing trade by the wide adoption of electric power throughout the country has been felt greatly by the Northern Car Co., and the manufacture of electric cars constitutes a most important part of their business. They have built a large number of the recent electric cars installed on the Minneapolis Street railway, and number many other prominent street railway companies in the West and Northwest, especially, among their customers.

The R. D. Nuttall Company.

These well known manufacturers present as their report for the past year a very extensive record of business in all lines of electrical supplies manufactured by them.

The popularity of the Nuttall trolley is self evident, from the large amount sold since placing it on the market nine months ago, the number being 633. Among the street railway companies which have recently adopted the Nuttall trolley upon all of their cars are the Second Avenue Passenger Railway Co., and Citizens' Traction Co., of Pittsburgh, Pa. and the Wheeling Railway Co. The Nuttall company have made extensive improvements in their pattern of trolley during the past few months, and it, at present, is so much improved over the original patent that they say that the two are hardly to be compared. They have lately brought out a steel railway pole made of spring steel drawn in one solid piece without brazing, and tapering from end to end. This pole is practically indestructible, and when bent can be straightened cold without injury to the metal. Orders have been booked during the past month for 1,065 poles, fitted with improved trolley harps and side contact springs.

The Nuttall company expect soon to place on the market a new departure in railway motor gearing made of rawhide throughout, under patents granted recently to Mr. J. F. Pfetich, manager of the principal street railway company at Erie, Pa. Mr. Pfetich has in Erie, Pa., one car now equipped with this gearing, which has been operating for the past fourteen months, and in all that time the car has not once been laid up for repairs to gearing, the original wheels being still in place and doing good service.

The gear trade in general has been growing very rapidly with the Nuttall company during the past year. Since they went into this business upon an extensive way they have added much improved machinery and appliances of their own design, which have enabled them to place a superior article on the market at almost 100 per cent. less cost than the same could be had two years ago. The Nuttall gears have, therefore, made a name for themselves, which the managers of that company attribute to the extensive experience had by them in the manufacture of these articles, and the improvements they have been making from time to time, and are still making.

The Nuttall rawhide pinions are in such demand by street railway companies, that though the number produced at their factory at present is fifty per day, the company find themselves unable to get a stock of these goods ahead. Their production in gears and pinions, for the different systems, in the past year has been about 18,000 including all. If the trade in same keeps up in the future, as it has in the past, they think that their next year's business will be almost double this number. They have also added in the past six months a commutator department to their factory where they are at present producing commutators for all systems in large quantities.

They have also just completed new patterns and tools for the production of motor gearing made of cast steel, and have booked some very large orders for cast steel gears this month.

They have lately made arrangements to open a branch house in St. Louis, and have appointed T. C. White & Co., general agents in that city. This had to be done as their trade in this section has grown very rapidly in the past six months, and was too much to handle from the home office. They expect to have their new catalogue ready for distribution the first of the year. It will embrace cuts and general descriptions of all the articles of their manufacture, giving prices, numbers of articles, and a telegraphic code for the facilitation of their many patrons. It will also give a few instructions in regard to the care of motors, and electrical railway machinery generally.

Street Railway News.

General.

Austin, Tex.—The Austin City Railroad Co., have awarded a contract for the electrical equipment of their lines, consisting of about five miles of road, with motor cars to the Thomson-Houston Electric Co.

Baltimore, Md.—The Traction syndicate is said to be negotiating for a controlling interest in the York Road Railway, and the Union Passenger Railway. If the Traction company get possession both roads will probably be cabled.

THE Baltimore City Passenger Railway Co. have awarded the contract for cabling the Red and White lines to E. D. Smith & Son, formerly from Philadelphia, but now of Baltimore.

THE Baltimore Traction Co. have purchased the Epworth church property to be utilized as the site of one of the cable power houses. The same company have received several new open cars, canary colored and having a seating capacity for twenty-four persons, recently ordered by them from the Brownell Car Co., of St. Louis.

THE contract for cable castings for the Baltimore City Passenger Railway has been awarded to Reed, Stickney & Co., agents for the Davis & Thomas, of Catasauqua, Pa., for twenty-eight dollars per ton. This contract includes such material required, except a previous order given to the Pennsylvania Steel Co.

Boston, Mass.—A municipal ordinance has been introduced prohibiting a speed of electric cars of more than seven miles an hour, unless the car be provided with proper fenders.

Brooklyn, N. Y.—The General Term of the Superior Court last month confirmed the report of the Commissioners in favor of the application of the Coney Island & Brooklyn Railroad Co. for permission to operate their road by the trolley system to Ninth Street. The change in the power will probably soon be made since the consent of the State Board of Railroad Commissioners has been secured. The property of persons opposed to the trolley in Ninth Avenue has been purchased by the company. Active work upon the electric equipment will now probably be begun in the spring. The conditions set forth in the report of the Railroad Committee to which the street railway companies will comply are that the wires shall be attached to iron or steel poles, not less than twenty feet in height, erected on the curb lines of the streets, save where there are elevated railroad tracks, where the wires may be attached to the superstructure. The rate of speed is to be such as to secure to the public the advantage of more speedy transit, the rate not to exceed ten miles an hour. Each company shall be under a bond of \$150,000 for the faithful performance of the conditions of the franchise.

A NEW compound engine has been put on the Kings County Elevated Railroad. There is a high pressure cylinder, twelve and a half inches, on one side and a low pressure cylinder, twenty inches diameter, on the other. The engine is reported as giving general satisfaction.

Canton, O.—Superintendent A. G. Davids has resigned his position with the Canton Street Railway Co. Mr. Catlin, the assistant superintendent, will succeed Mr. Davids, temporarily.

Chicago, Ill.—At a conference held last month between General Counsel Grinnell of the Chicago City Railway Co. and the Council sub-committee on streets and alleys, south, the company agreed to build cross lines on Thirty-fifth, Forty-seventh and one other street this winter, to be followed by two more cross lines in the spring. In return for these concessions the sub-committee will probably report in favor of passing an ordinance for the new Wabash Avenue loop desired by the company. In order to relieve the crowded condition of the cars on the main lines the company will make a trial of the Pullman double decked cars.

JOHN A. BELL was appointed a receiver of the Russell Street Car-ette Co., December 22, in place of Dr. Frederick Pond. The change was made at the request of stockholders who thought a different appointment should be made because Dr. Pond is interested with Senator Evans in a \$10,000 mortgage on the property of the company.

AT a recent meeting of the City Council a preamble and resolution were introduced setting forth that the street railroad companies had issued an order directing that passes should not be issued to police officers not in uniform, and providing that a committee of three be appointed by the Chair to wait upon the three street railroad companies and, if possible, arrange for the issuance of transportation to such members of the Police Department, whether in uniform or otherwise, as the Superintendent of Police may request and Sanitary officers.

THE enlargement of the plant of the Cicero & Proviso Street Railway Co. is well under way. The Pond Engineering Co., through their Chicago office, are reconstructing the pipe work and are furnishing an 800 H.P. Hoppes exhaust feed water heater, two Pond separators to insure dry steam and a large boiler feed pump of improved construction.

Denver, Colo.—The Denver Tramway Co. will build a large brick car house and repair shop at Twenty-first and Gilpin Streets, to cost in the neighborhood of \$27,000. The dimensions are 265×125 ft. The floor of the shop contains eleven tracks and other side tracks for storage purposes. The space underneath is excavated for repairing the motors. The completion of this building will result in the abandoning of the storage house at Colfax and Broadway.

THE Board of Supervisors have passed a bill regulating the size of street cars. The length of cars is not to be over thirty-seven and a half feet, including platform, and the width not over seven feet ten inches; only one trailer will be allowed.

Dubuque, Ia.—Dr. W. L. Allen has announced his intention to retire from the presidency of the Dubuque Electric Street Railway, Light & Power Co.

Gloucester, Mass.—Mr. A. Martin has resigned the superintendency of the Gloucester Street Railway.

Helena, Mont.—The Denver & Helena Investment Co. have sold the line of the Union Electric Railway to New York capitalists, represented by J. H. Lawrence. The New York syndicate made the purchase for the purpose of consolidating with the Steam Motor Co.'s property in this city. The consideration in the deal was said to be \$85,000, of which the Denver parties took stock to the amount of \$40,000 in the new concern.

Houston, Tex.—The Houston City Street Railway Co. will at once commence to build a large car house and car shops on Commerce Street.

Ishpeming, Mich.—It was expected that cars would be running over the Ishpeming-Negaunee electric line not later than Christmas.

Ithaca, N. Y.—A majority of the stock of the Ithaca Street Railway is said to have been recently purchased by A. C. Robinson & Co., of Wilkes-Barre, Pa. The road will probably be extended and improved.

Kalamazoo, Mich.—The Knickerbocker Trust Co. filed a petition in the United States Court last month for a receiver to be appointed for the street railway company here. The petition was granted. W. R. Adams, of New York, was appointed. By the arrangements Mr. Adams is authorized to issue \$10,000 of receiver's certificates to secure all creditors.

Kearney, Neb.—It is said that the Kearney Electric Co. sell for \$1 per month tickets good for any number of rides. Burton heaters have been adopted on the road.

Lansing, Mich.—A deal has taken place here by which the Continental Trust Co. of New York have taken an interest in the City Railway. The stock of the company is increased from \$50,000 to \$175,000, the larger part of which is owned by the trust company, Hollister & Skinner retaining an interest and Messrs. Nelson Brady and O. M. Barnes each taking \$1,000 of the stock. The road, from one end to the other, will be relaid with new forty-five pound T rails. A new power house will be built immediately on a site yet to be selected, and the company will furnish their own power for the entire line.

Laramie, Wyo.—The Laramie City Tramway Co. have issued their bonds and will now build six miles of road, receiving subsidies to the amount of about \$40,000. They have two miles more of road under consideration. The franchise of the company is exclusive, and runs the full constitutional limit of the time.

Lebanon, Pa.—Two new and handsome cars have recently been received by the Lebanon & Annville Railway Co. from the works of the Lewis & Fowler Manufacturing Co., of Brooklyn, N. Y.

Logansport, Ind.—The electric road put in operation during the last week of November has been running very successfully. The Edison system is in use.

Los Angeles, Cal.—The electric line on Maple Street has been put in operation.

Lynn, Mass.—President A. F. Breed of the Lynn & Boston Railway Co., is quoted as saying that the seventy miles of track in the city will be equipped with electrical apparatus within another year.

Milwaukee, Wis.—The Milwaukee & Wauwatosa Rapid Transit Co. have purchased the electric light plant at Wauwatosa. It will be used to operate the suburban railroad line built a short time ago by the Transit company. The plant is equipped with two 225 light incandescent dynamos and the necessary engines for their operation. It is probable that the building will be remodeled so as to adapt it to the needs of the railway company, but the electric lighting of the streets in Wauwatosa will also be continued.

Minneapolis, Minn.—A number of changes have been made during the past month preparatory for the winter. A number of cars have been equipped with Burton electric heaters, and several snow plows have been purchased.

W. F. CARR has resigned his position of chief engineer of construction of the Minneapolis Street Railway Co. He will spend the winter in the South.

THE company have placed an order with the Northern Car Co. for sixteen new eighteen foot electric cars for local use, the same size as those now running. They will be numbered from 523 to 539, painted yellow and finished in cherry.

Montreal, Can.—Mr. R. A. Mainwaring of 147 St. James Street, in regard to the proposed electric railroad in Montreal, gives the contemplated length of single track as about twenty miles. The gauge will be 4 ft. 8½ ins., and about fifty cars will be used. The rail inside the city will be a girder rail, outside the city a T rail of fifty-six pounds. Electricity will be the motive power used, but whose system is not definitely settled. As soon as the franchise is obtained a company will be organized under the charter of the Montreal Elevated Railroad Co., with a capital of \$1,000,000. If the franchise is awarded building will commence about next April.

Nashville, Tenn.—Stoves have been installed in the cars of the Citizens' Rapid Transit Co.

Natick, Mass.—The Natick Electric Street Railway Co. have voted to issue scholars' tickets. These tickets will be sold in packages of thirty-three for \$1.

New Haven, Conn.—Work on the new Winchester Avenue line is being pushed. When this is completed through cars will be run from Newhallville to the depot.

THE State Street line people are laying double tracks upon a considerable portion of their route.

New Orleans, La.—The city will offer at public auction on February 10, 1892, at the City Hall, right of way over a number of streets.

ON December 1, the Mayor sent a lengthy communication to the Common Council stating that, in his opinion, the best interests of the city would be conserved by the adoption of the overhead system for its street railways. As New Orleans has heretofore opposed the overhead wires vigorously, the communication was received with more than ordinary interest.

It is thought that the New Orleans & Carrollton Railroad will be granted permission to use the overhead system.

New Rochelle, N. Y.—The New Rochelle Railway & Transit Co. have completed a new piece of track on Huguenot Street and laid their tracks on Bridge Street. Cars are already running over the section. A sixty pound centre bearing rail with Johnson switches and curves was used on this extension. Patrons along the line of route can now ride directly from the railroad station to their homes in New Rochelle without leaving shelter on stormy days.

Newburyport, Mass.—James F. Shaw, superintendent of the Black Rocks & Salisbury Beach Street Railway Co., has temporarily resigned for the winter, in order to give his time to the introduction of his new patent trolley wheel.

THE new brick car house of the Newburyport & Amesbury Electric Railway Co. has just been completed, and it is said to be one of the most convenient and handsomest in the State.

A COMPANY is being formed by Lowell and Haverhill capitalists to build a new road from Lowell through Lawrence to Haverhill, thence to Newburyport, via Merrimac and Amesbury. Capital \$600,000.

HON. E. F. SHAW, president of the Black Rocks & Salisbury Beach Street Railway Co. of this city, and connected with many other roads in New England, has been elected Senator in the Fourth Senatorial District of Massachusetts.

New York, N. Y.—John McQuade, sub contractor with William Wharton Jr., & Co., on the Third Avenue Cable Railway, has brought suit against the Philadelphia firm for work done on the cable road.

THE New York & Queens County Tunnel Railroad Co. have been organized with a capital stock of \$40,000, the road to be constructed for a length of three and a half miles under the waters of the North and East rivers, and to be operated by steam, electricity or other motive power. The directors include: Joseph F. Carey and Joseph Lowery of Brooklyn; Jason W. Broadhead and Joseph H. Jones of New York City, and Robert Morris, of Greenville, N. J.

A PROTEST has been made by a number of Madison Avenue residents against the proposed tunnel of the Rapid Transit system under that avenue.

COMMISSIONER Gilroy, who in the early part of December announced that on the tenth all work on the Third Avenue Cable Road would have to be stopped, reconsidered his decision, and allowed it to go on as long as the weather permitted. The contractors are using every diligence to hurry the work, and gangs of men are working night and day on the road.

A COMPLICATED railway suit was brought last month to the Superior Court, special term, before Judge O'Brien. The case is one involving the right of the Twenty-third Street Railroad Co. to run their cars in Fourteenth Street, between Ninth and Fourth Avenues, over the road owned or leased by the Christopher & Tenth Street Railroad Co., and the Central Crosstown Railroad Co. The plaintiffs complain that, according to a lease made in 1884 between defendants and themselves, the right to run their cars over the Fourteenth Street tracks as far east as Fourth Avenue was established. Their present action is to enjoin the defendants from interfering with their use of the Fourteenth Street road. Defendants say that they do not so understand the terms of the lease.

EXPERIMENTS are being tried on the Broadway road with the Pintsch gas system for illuminating the street cars. Some very satisfactory results have been obtained.

Northampton, Mass.—E. C. Clark has been appointed superintendent of the Horse Railroad Co. The number of passengers carried for the year ending December 1 was 372,290. Number of miles run, 83,534. Number of trips made, 13,053.

Norwich, Conn.—The Norwich Street Railway Co. have fitted their closed cars with the Lewis & Fowler stoves.

Oakland, Cal.—Track laying on the Mountain View cemetery branch of the electric road and on the Piedmont district is progressing rapidly. In accordance with a petition of the property owners on Booth Street, which is macadamized, the Board of Supervisors inserted a clause in the franchise of the company to macadamize the road seven feet on each side of the track.

It is stated that the Oakland Consolidated Co. will not build an electric power house at Seventeenth and Wood Streets, where they bought land, but will obtain power for their cross town road from the present power house at Temescal.

THE road of the East Oakland Street Railroad Co. will probably be in operation in a month. The tracks are completed to Fifth Avenue and East Eighteenth Street. The roadbed will be completed before many weeks.

THE Haywards road is being built and a power house is being constructed at the Warner tract.

Ogden, Utah.—Col. R. M. Spivey has been appointed General manager of the Ogden Electric Street Railway system to succeed H. C. Gilbert, resigned. Colonel Spivey has had wide experience in railway and land matters, and the street railway company may be congratulated on his acquisition.

Oswego, N. Y.—At a meeting of the directors of the Oswego Street Railway Co. held lately E. A. Van Horne was elected general manager of the road, Mr. Callenen retiring from active management.

Ottumwa, Ia.—The Steam Heat & Electric Light Co. and the Electric Railway Co. were consolidated last month into one, called the Ottumwa Electric Railway Co., and the capital stock increased from \$200,000 to \$500,000. Three members of the old street railway company, Messrs. Merrill, Mahon and Garner have retired.

Paterson, N. J.—The electric system in Paterson began running regular trips December 14, on fifteen minutes headway, between Passaic and the corner of Main and Market Streets. There is now complete electric communication between the centres of Paterson and Passaic, a distance of about five miles. The line construction was done by the Field Engineering Co. of New York.

Philadelphia, Pa.—It is virtually settled that the Thirteenth and Fifteenth Streets Railway is to become a part of the Traction company's system. The terms are said to include a rising scale of guaranteed dividends, beginning at ten dollars per share per year and increasing until the maximum of twelve dollars per share per year has been reached, at which rate they will remain.

THE Traction company's declaration of their intention to parallel the lines of the People's Passenger Railway by running omnibuses on Broad Street and Girard Avenue has taken tangible form in the application of David H. Lane to Chief Bullock of the Bureau of Highways, for licenses for 100 "buses" to be controlled by the Philadelphia Traction Co. The proposed route is on Broad Street from Germantown Avenue to Snyder Avenue, and on Girard Avenue from Belmont Avenue to East Norris Street. This action is regarded as a move to enable the Traction company to more easily secure control of the People's line, which, it is said, the Traction company are trying to accomplish.

Pittsburgh, Pa.—The Pittsburgh & Birmingham Traction Co. have assumed control of the Pittsburgh & Knoxville Incline Plane Railway under an agreement and will at once commence the construction of the system of hill top street railways contemplated by the Knoxville company.

THE Pittsburgh, Knoxville & St. Clair Electric Railway were lately sold at the suit of the receiver, to Murray Verner, for \$2,500, subject to a mortgage of \$60,000 and receiver's certificates amounting to \$18,000, \$78,000 in all, making the price of the road \$80,500. This was the first electric road built in Pittsburgh. It is said that it is the intention of the Birmingham Traction Co. to make use of a portion of these lines in completing the system of railways proposed for Allentown, Knoxville and vicinity. That portion of the old road below Washington Avenue will be abandoned.

RUMORS of a consolidation between the Duquesne Traction Co. and the Pittsburgh Traction Co. have for a long time been current, but on December 17 the subject was submitted to the stockholders of both companies. The basis of the adjustment is said to be that the earnings of both lines will be pooled, the expenses and interest on the bonded indebtedness paid from the common fund and the balance of the earnings divided on a ratio of fifty-five for the Pittsburgh company to forty-five for the Duquesne. This arrangement will be perpetual.

E. W. DAVIS, superintendent of the Fifth Avenue traction line, has tendered his resignation, to go into effect on January 1. It is understood that William Elkins, son of the president of the company will take Mr. Davis' place.

THE all night cars put on last month by the Duquesne company have been doing far more business than was expected of them. Nearly 200 passengers have been hauled every night thus far, but the officials think this will not continue, and as soon as the novelty wears off the patronage will settle down a little, but an average of even 100 passengers per night will pay all expenses.

AT the recent fire which occurred at the barns of the Second Avenue Passenger Railway Co., of Pittsburgh, it was discovered, in making an investigation of the wreck, that the Westinghouse electric motors had passed through the fire without injury and could immediately be put into service. The railway company since the fire have purchased from the Westinghouse company additional equipments to replace all those of other make which were destroyed by the fire. The small horse cars belonging to this line, which at present are used on the Tenth Street bridge division, will be abandoned, and the line will be equipped electrically. Mr. J. C. Riley has recently been elected secretary in place of C. G. Milnor, resigned.

THE Citizens' Traction Co., at the annual meeting of the stockholders, elected the following board of directors: James Verner, John G. Holmes, James J. Donnell, John B. Jackson, C. L. Magee, H. S. A. Stewart and John Gripp. The board re-elected the old officers. The comparative exhibit of passenger business of the road for the year ending November 1 last, as reported at the meeting, is as follows: 1891, 12,508,969; 1890, 11,640,532; gain, 836,437.

Portland, Me.—It looks now as if Westbrook would be connected with Portland by an electric railroad next summer. A proposition to this effect is before the city government.

Providence, R. I.—Several car bodies for the electric street railway have arrived from Newburyport, Mass. The cars are thirty-

five feet long and of the standard width. The base frames are of hard pine, with ash cross beams and of cherry finish. The opening of the road will occur January 1, if possible.

Rochester, N. Y.—Another 150 H. P. generator was received at the power house of the street railway company last month and was put in operation. The management hope to have electric cars running on all the lines of the city by the middle of the summer.

GENERAL MANAGER C. K. MINARY has resigned.

THE Charlotte Electric Railway Co. have voted to double the equipment of the road. The present plant located just this side of Charlotte, consists of one 250 H. P. engine and two eighty H. P. generators.

St. John, N. B.—Charles D. Jones, manager for the Eastern Electric Co., in this city, has been appointed general manager and a managing director of the St. John City Railway Co.

St. Joseph, Mo.—The barn of the Union Railway Co. was burned on November 30. Thirty cars equipped with electric motors were burned. The loss is \$50,000; fully covered by insurance.

St. Louis, Mo.—A new cable rope has been installed on the Broadway cable line from Pine Street north. The length is about nine miles. The cable taken out rendered good service, running 63,000 miles in little less than a year.

St. Paul, Minn.—The car barns of the street railway company on West 7th Street burned to the ground last month. The barn had recently been used as a storehouse, and twenty-three disused cars stood in it. The loss is \$2,000 on the building and \$8,500 on contents fully insured.

Salem, Mass.—The Naumkeag street railway has absorbed the Essex electric road of Salem and Peabody. The roads will be continued as nominally separate corporations, but practically as one, and there will, no doubt, be some important changes.

THE managers of the consolidated roads have appointed J. F. Hickey general manager of the two roads; James Learey, traffic manager (a new office) and John H. Bickford electrical engineer. The positions of division superintendents are abolished.

San Francisco, Cal.—At the annual meeting of the San Francisco & San Mateo Electric Railroad Co., Behrend Joost, C. C. Butler, Fabian Joost, J. W. Hartzell and W. F. Thomas were re-elected directors. The old officers were chosen. The secretary reported that twenty-one miles of single track had been constructed, beside power and car houses. He reported, also, that the road would probably be running to the Holy Cross cemetery about January 1, 1892. He reported, further that the officers had filed the required notice that \$50,000 had been expended on work within the time set by law, and the board had accepted the report.

San Jose, Cal.—F. Chappellet states that the Patton motor may be used on the line between Haywards and San Jose.

Santa Cruz, Cal.—The Santa Cruz, Garfield Park & Capitola Electric Railway was opened November 25.

Spokane Falls, Wash.—The public is greatly divided over the question of whether it is to the best interests of Spokane to grant to the Spokane Street Railway Co. authority to haul freight cars over their various lines in this city. The franchise asked for simply gives the company the right to move freight cars during the night between 12 o'clock, midnight, and 6 A. M.

Springfield, Mass.—The Springfield Street Railway Co.'s stables were lately damaged by a fire which originated from a furnace and soon reached three barrels of oil, which exploded with deafening report. The flames spread rapidly, but all the electric cars on the ground floor were removed without loss. The damage to the building is estimated at \$10,000, fully covered by insurance.

Superior, Wis.—Three additional motor cars have been received by the street railway company. These make nine new cars in all received recently.

Toronto, Ont.—Engineer Cunningham has presented a very large and elaborate report on the system of electric street cars to be adopted in the city. He visited Buffalo, Cleveland, Pittsburgh, Allegheny, Washington, New York, Newark, Albany, Boston, Springfield, and other American cities, and inspected the various systems very carefully. A mass of information is given in the report, and the engineer concludes by recommending the adoption of the overhead trolley system in Toronto.

Vancouver, B. C.—The electric tramway to connect Vancouver and Westminster has been completed and the traffic is even greater than was expected. The electric tramway systems of Victoria and Vancouver have been very successful and considerably extended, and a third established in Westminster.

F. L. DAME, superintendent of the Vancouver Electric Railway, Light & Power Co. has resigned, and has taken a position with the Thomson-Houston Electric Co. as district engineer, with headquarters at Portland, Ore.

Vicksburg, Miss.—The long fight between the city and the street railroad has finally culminated in the execution of the former's repeated threat to destroy the road's track. The railroad company made no effort to stop the work by injunction, but, it is understood, will sue for damages in the United States Court.

Washington, D. C.—In a recent interview Senator McMillan of Michigan, chairman of the Senate Committee of the District of Columbia, expressed himself as opposed to the further extension of the overhead system in the City of Washington,

Windsor, Ont.—When the electric railway was being built in Windsor there was some friction between the Council and the company about running powers on the streets, and pending a settlement the Mayor ordered work to be stopped, and arrested four men who were subsequently released on bail. These men now propose to have redress, and their solicitor has served notices on Mayor Flemming and the police officers that they would at once begin suit for false imprisonment. They want 5,000 damages.

Worcester, Mass.—The annual report of the Consolidated Street Railway Co. contains the following figures: Passengers carried, 607,100; round trips run, 17,000; receipts, \$273,000; expenditures, \$223,000; horses owned, 457, rolling stock forty-five box and forty-six open cars.

T. FAIRBROTHER has been appointed superintendent in place of J. B. Chapin, resigned.

Extensions and Improvements.

Atlanta, Ga.—The Atlanta Consolidated Street Railway Co. recently voted to build a two mile extension.

Boston, Mass.—The West End Street Railway Co. have been granted permission to extend the overhead system and lay double tracks on Mt. Auburn Street in Cambridge.

Chicago, Ill.—The Calumet Electric Street Railroad Co. propose to extend their lines on Michigan Avenue from Kensington Avenue to 110th Street, west on 110th Street to Wentworth Avenue, thence north on Wentworth to 116th Street and east on 116th Street to Michigan Avenue. The company, it is stated, have secured consents from the owners of 90,500 ft. out of a total of 155,000 ft. The present line of the company is on Ninety-third Street.

Columbia, S. C.—A bill has been introduced to authorize the consolidation of the Columbia Electric Street & Suburban Railway & Electric Power Co., and the Congaree Gas & Electric Co., under the name of "The Columbia Electric Street Railway, Light & Power Co."

Columbus, O.—The Columbus Consolidated Street Railroad Co. are making arrangements to largely increase their steam plant in the near future.

Corsicana, Tex.—The Corsicana Street Railway will probably be equipped with electric power.

Dallas, Tex.—It is reported that the entire property of the Dallas Cable Railway has been purchased by a syndicate which will immediately commence work with the object of placing it in operation.

THE Dallas & Oak Cliff Dummy Co. propose equipping their lines with electric power.

Detroit, Mich.—An application has been made by Capt. W. H. Stevens and Frank E. Snow for a street railway franchise over Atwater, Griswold and Shelby Streets and Michigan, Washington, Woodward and other avenues to Pallister Road.

Du Bois, Pa.—The street railway company intend to extend their line to Falls Creek next year and equip with electricity.

Dubuque, Ia.—It is reported that storage batteries will be abandoned on the Rhombberg line in the spring, and that overhead wires will be adopted.

Gadsden, Ala.—The Gadsden & Attalla dummy line will probably be equipped with electric motors.

Harrisburgh, Pa.—The East Harrisburgh Passenger Railway Co. are pushing their road to Steelton.

Hartford, Conn.—The Hartford & Wethersfield Horse Railroad Co. have received permission from both boards of the Common Council to run trolley cars between the City Hall and the East Hartford bridge. The road bed and overhead system are all ready for the new cars.

Malden, Mass.—The East Middlesex Street Railway Co. have petitioned for location of double track on Main, Salem, Ferry and other streets.

Marlboro, Mass.—The Marlboro Street Railway Co. have asked for permission to extend their road to Hudson and Westboro.

Milwaukee, Wis.—A number of important extensions of the street railway system here are proposed.

Muskegon, Mich.—Great improvements are to be made by the Muskegon Street Railway Co. They are to increase their power by the addition of a 250 H. P. engine, and a new dynamo. They contemplate extending the line to North Muskegon and making a loop line of the Sandford Street route. They will probably extend from Muskegon Heights to Mona Lake, providing the owners of the property there convert it into a park.

New Berne, N. C.—It is said that the Electric Street Railway Co. will extend their line to Pollockville and Trenton. It is said that this company has paid a nineteen per cent. dividend for the first twelve months.

New Haven, Conn.—The West Haven Horse Railroad Co. have petitioned the Board of Public Works for permission to lay a temporary track on Chapel Street from Temple Street to College Street.

Newark, N. J.—The Newark Passenger Railway Co. have been given permission to lay tracks in South Fourteenth Street, to connect the lines of the Rapid Transit and Orange systems. It was stipulated that the poles should be ornamental iron ones, and that temporary wooden poles may be used between Central and Ninth Avenues until the latter thoroughfare is graded.

THE extension of the Rapid Transit railroad's electric power house is nearly completed, under the direction of Architect Albert Phillips,

and 1,000 H. P. will soon be available for electric railroad service. This will double the capacity. The Orange extension of the line is about completed.

Norwich, Conn.—At a recent meeting of the stockholders and directors of the Norwich Street Railway Co. it was voted to introduce electric rapid transit on their lines immediately after obtaining the consent of the Common Council. The company intend to lease power of the Norwich Electric Light Co., if possible, or failing in that to set up their own plant.

Oakland, Cal.—The work of changing the Telegraph Avenue horse car line into an electric road will probably be begun by the first of this year.

THE Oakland & Berkeley Rapid Transit Co. are now building a branch from Fortieth and Grove Streets to Mountain View cemetery, two miles long, with a double track. They are also building the road across the Sixteenth Street marsh. They will build from Wood Street along Eighth to Grove and from Grove to Thirteenth Street, and as soon as they get a franchise from the City Council, which has been applied for, will extend the road from Second and Broadway along Second to Market.

Peterboro, Ont.—The charter for the new electric road in this city, for which there are two companies applying, includes a stipulation that the company applying and obtaining it shall provide and keep in repair eighteen inches of roadbed on either side of the track with stone pavement.

Ottawa, Ont.—Messrs. Aitern and Soper, managers and principal owners of the electric street railway, who recently purchased the controlling interest in the old horse car company, will make application for an amendment to the charter to enable them to equip the line with electricity.

Portland, Ore.—The Portland & Fairview Railway Co. have been granted a franchise to lay down and operate a street railway on the road forming a portion of the east boundary of the city.

THE City & Suburban Railway Co. have been authorized to construct and operate a double track road on Morrison Street from Front to Fifteenth.

A CONTRACT has been made between the City & Suburban Railway Co. and the promoters of the Portland & Fairhaven system, by which the former company have bound themselves to build a line on G Street from Fifth to Twenty-eighth, thence to Rosenthal's place, northeast of Mount Tabor.

Richmond, Va.—A petition from the Richmond Railway & Electric Co. asking permission to extend their road from Twenty-first and Broad Streets along Broad to Twenty-fourth Street to connect at both ends with the present track, has been presented to the Council.

Sacramento, Cal.—The Central Railway Co., which has purchased the lines of the City Railway Co., propose to commence immediately to equip all the lines with the electric system.

Saginaw, Mich.—The Saginaw Union Street Railway Co., are having prepared plans for a new power house to be erected this winter at some convenient point on the river front and which, with engines, boilers and buildings, will cost about \$25,000. It will be provided with four 150 H. P. engines, three Babcock boilers, and an additional 150 H. P. dynamo.

St. Cloud, Minn.—The Board of County Commissioners has granted the right of way to the street railway company for laying a track along the county road to the Great Northern shops. Work will be commenced at once. The overhead system will be used.

St. Joseph, Mo.—The People's Street Railway Co. are making some important improvements in their rolling stock.

Seattle, Wash.—The Board of Trustees of the South Seattle Electric Railway Co. have let the contract for the furnishing of electric cars and other fittings to the Northwest Thomson-Houston Electric Co. The present line down Commercial Street from King Street to South Seattle, a distance of two and a half miles, is to be changed from a steam motor into an electric line, and is to be extended up Commercial to Main Street. It was proposed to have the work completed by the beginning of this month (January).

Tacoma, Wash.—Three largely signed petitions have been circulated in the Fourth ward asking the Tacoma Railway & Motor Co. to extend their line to Wright Avenue.

New Roads.

Alexandria, Va.—The officers of the newly organized Alexandria & Fairfax Passenger Railway are D. E. Leech, president, S. W. Speer, secretary and treasurer. The president is a New York capitalist and financier. J. S. Swartz, of Philadelphia, president of the Red Star steamship line, is also interested.

Aspen, Colo.—J. R. Pemberton of Detroit and T. J. Flynn of this place, are organizing a street railway company.

Astoria, N. Y.—The Astoria street railroad company have been incorporated. The road is to run from the foot of Fulton Street, East river, to the town of Newtown, is to be two miles long and have a double track. The capital stock is \$100,000. The directors include Edward M. Tyrrell of Brooklyn, Michael E. Conway, James Robinson and James E. McWilliams of Long Island City, and John J. Delaney of College Point.

Benton Harbor, Mich.—F. S. Hopkins has presented an ordinance asking for a franchise for the Benton Harbor Street Railway Co.

Brantford, Ont.—A proposition entailing an outlay of \$60,000 has been submitted to the Brantford Council for the establishment of a system of electric street cars. The company ask for exemption from taxation for ten years and a franchise for thirty years, with the option of purchase by the city at the end of that time.

Brooklyn, Md.—Curtis Bay will have an electric road in operation from this place by April 1. Power and car houses will be built at Curtis Bay. A 300 H. P. steam plant will be in the power house, which will be 50×90 ft. while the car house will be built of iron 60×150 ft. The station will be built at Brooklyn, near Acton's Park.

Brooklyn, N. Y.—Consents are being secured from property owners in Bedford Avenue by Henry B. Buckhout and Frederick R. Jorgenson for a street railway under the name of the Bedford Avenue & Flatbush Railroad Co.

Bucyrus, O.—The Crawford County Commissioners have granted a franchise to a company to construct an electric railway between Bucyrus and Galion. The work is to begin at once. C. W. Fisher is president.

Burlington, Vt.—The Vermont Electric Co. propose to construct an electric railway through the city from Winooski to the Oak Lodge property. The overhead system will be used. The company will use the water power at the "gorge" near the twin bridges, and will furnish electric power to stationary electric motors. Four cars will be installed at first.

Chicago, Ill.—The Chicago, West Ridge & Waukegan Electric Railway Co. have been incorporated to operate an electric street railway from Chicago to Waukegan and the state line; capital stock, \$15,000,000; incorporators, Orrin T. Maxson; Frank H. Doland, Frederick S. Capron and Charles Steinbess.

A CERTIFICATE of incorporation has been issued to the West Side Rapid Transit Co., capital stock, \$2,000,000 to construct elevated railways on several streets; incorporators, Oscar W. Rogers, K. L. Baldwin and G. M. Miller.

THE U. S. Rapid Transit Co. have been incorporated with capital stock of \$5,000,000 for constructing and operating mechanical appliances for rapid transit of U. S. mail, passengers, etc.

THE International Electric Railway Co. have been organized in Chicago to exploit the Applegate electric railway system. The capital stock is \$2,500,000 and the officers are C. B. Holmes, president; Henry P. Daily, vice-president; W. H. Applegate, treasurer; W. S. Garvey, secretary.

PERSONS interested in property near Seventy-fifth Street, Chicago, are anxious to have a street railway constructed on that street by the Chicago City Railway Co. At a recent meeting of property owners it was agreed to guarantee the company \$40,000 if they would build the road.

Columbus, Miss.—The City Council have granted a charter to a stock company to build a street railroad. The latter agree to have everything in working order by April 1.

Columbus, O.—The directors of the new Worthington, Clintonville & Columbus Street Railway Co. have elected O. W. Aldrich, president; F. F. Tuller, vice-president; R. M. Weaver, secretary; H. C. Cooke, treasurer. The capital stock is \$10,000.

Council Bluffs, Ia.—The Council Bluffs Transit Co. have been granted permission to install an electric line to the Chataqua grounds.

Delaware, O.—The council have awarded the bid for an electric street railway over the principal streets of this city to J. K. Newcomer, and have authorized the construction of a street railway.

Des Moines, Ia.—The Des Moines Water Power & Electric Co. have been incorporated. The capital stock is \$225,000, and the incorporators Lowry W. Goode, Fred D. Goode and C. K. Mead.

East St. Louis, Ill.—The Venice Transportation Co., East St. Louis, with a capital of \$10,000 have been incorporated.

Florence, Neb.—The Omaha & Florence Street Railway Co. have filed articles of incorporation. Authorized capital \$200,000. The incorporators are H. G. Clark, E. H. Walker, R. H. Olmstead, Frank E. McCoy and Owen T. Smith.

Fort Wayne, Ind.—The Industrial Park Land Co. will build a short line on John Street to the Park. Horse power will probably be used.

Fostoria, O.—Certain parties in Findlay and Fostoria are quietly pushing a scheme to connect the two cities by an electric street railway. The distance is only sixteen miles and the idea is feasible.

Galveston, Tex.—The South Texas Construction Co. propose the construction of an electric railway.

Grand Rapids, Mich.—The Grand Rapids Electric Street Railway Co. have asked for permission to construct an electric railway in Spring, Louis, Campau, Fulton and Waterloo Streets, and Godfrey, Clyde, Park and Burton Avenues.

Hamilton, Ont.—C. J. Myles, one of the lessees of the Hamilton & Dundas Street Railway, is forming a company to build an electric railway from Hamilton to Grimsby camp. The road will be twenty-two miles in length and will cost \$175,000; \$75,000 has already been subscribed, and as soon as a charter is obtained the road will be commenced.

Haverhill, Mass.—Charles Goss, L. J. Marston, N. Y. Ellis and others have incorporated the Haverhill & Amesbury Street Railway Co., with authority to construct and maintain a surface railway with electricity or other approved motive power.

Jacksonville, Ill.—The Jacksonville & Suburban Railway Co., with a capital stock of \$15,000 have been incorporated to operate a rail-

way by animal, steam or electric power; incorporators, William S. Hook, Marcus Hook, Francis Hook.

Lowell, Mass.—Alexander B. Bruce of Lawrence, Charles W. Morse of Haverhill, Joseph S. Brown of Lowell and others, have incorporated the Lowell, Lawrence & Haverhill Street Railway Co., with authority to construct and operate a surface railway between said cities.

Lynchburg, Va.—A charter for an electric road has been requested by Peter J. Otey, C. M. Blackford, W. H. Dulaney and others.

Marion, Ind.—D. Babst, Jr., has accepted the street railway franchise granted by the City Council. This assures the building of Marion's street railway.

THE Kokomo Electric Street Railway Co. have been granted a franchise to build a street car line from Marion to Jonesboro, in Grant County, a distance of four miles.

New Haven, Conn.—The New Haven & Allingtown Horse Railroad is now said to be an assured thing, and unless the city put some obstructions in the way of the purchasers of the old charter, the work of building the road will be commenced at once. L. H. Hinman is interested.

New York, N. Y.—Articles of incorporation were filed last month by John W. Hyatt, of Newark, Thomas W. Alcott, Louis Adler, Philip Payne and Benjamin Tuska, of New York, composing the newly formed New York Electric Railway Co. They propose to construct and operate railways of all kinds—surface, elevated and underground—and other improvements throughout the country. The total capital stock is provisionally fixed at \$25,000.

A CORPORATION calling itself the "Harlem & Kingsbridge Railway Co." was organized last month in the office of Luke T. Cozans in the Stewart Building, New York. The proposed route is as follows: Beginning at point adjoining the Mott Haven Depot of the New York Central & Hudson River Railroad Co., thence along 138th Street, across Madison Avenue Bridge over the Harlem River, thence along Madison Avenue to 135th Street, through 135th Street to St. Nicholas Avenue, through that avenue into the Kingsbridge Road, along the Kingsbridge Road over the Harlem Ship Canal and Spuyten Duyvil Creek connecting with the Kingsbridge stations of the New York Central & Hudson River Railroad and the New York & Northern road, thence along Broadway to the city limits at the Yonkers line. Double tracks will be used. The capital stock for the present has been fixed at \$300,000. Officers are Charles E. Runk, president; Wm. Forster, treasurer, and George P. H. McVay, secretary.

Niagara Falls, Ont.—The commissioners of the Queen Victoria Jubilee Park, have reached an agreement with the syndicate who propose building the electric railway along the bank of the Niagara River. This line will in time run from Niagara, on the lake, to Fort Erie, but for the present work will be done only on the section between Chippewa and Queenstown. The syndicate, it is said, gives a bonus of \$10,000 and agrees to pay a rental of \$10,000 a year. Surveyors are now mapping and staking out the route.

Ouray, Cal.—Articles of incorporation have been filed with the Secretary of State for the Ouray & Ironton Electric Railroad, Light & Power Co. The directors are Otto Mears and Fred. Walsen of Denver, Charles Munn of Ouray, J. H. Casonova of Phillipsburg, Pa., and W. A. Wallace of Clearfield, Pa. The capital is \$800,000. It is said that the construction of the road will be pushed at once. Should this road be built as projected it will be one of the most marvelous pieces of railroad building in the country.

Philadelphia, Pa.—The Quaker City Elevated Railroad Co. have incorporated to operate a line from the intersection of Ridge Avenue and Lehigh Avenue. Length of line, twelve miles; capital stock, \$150,000. Among the directors are Edwin Mechever, J. W. Kucker and William B. Stout, all of Philadelphia.

Pittsburgh, Pa.—The stockholders of the proposed Grandview Electric Railway on Mt. Washington & Duquesne Heights lately elected directors, who chose the following officers of the road: President, W. B. Lupton; secretary, F. W. Gordon; treasurer, W. T. Bowen. About \$20,000 of stock has been subscribed for and steps will be taken at once to get a charter.

BOTH branches of Councils have passed the ordinance giving the West End Passenger Railway Co. an almost exclusive right to build street railways in the West End.

Pomona, Cal.—The Pomona & Ontario Electric Railroad will be begun next spring. The electric system will be used, the current being generated by water power.

THE Pomona Electric Power Co. have sold stock to the amount of \$275,000.

Portsmouth, Va.—The Portsmouth Electric Railway Co. have applied for a charter, with Virginus Butt, A. J. Phillips, Edward Mahoney and others as incorporators. The capital stock is to be not less than \$10,000 nor more than \$100,000.

Richmond, Va.—The Petersburg Street Railway Co., with a capital of \$100,000, has been incorporated by George Beadle, Alexander Hamilton, Augustus Wright, and Walter S. Phillips.

St. Augustine, Fla.—The bond to guarantee the construction of the street railway here has been filed with the mayor.

San Francisco, Cal.—At the meeting of the Board of Supervisors lately an order was finally passed granting Irwin C. Stump, P. N. Lillenthal, Abner Doble, W. R. Hearst, William Hollis and others a franchise to build and maintain a street railroad from Mission and Sixth Streets, down Sixth to Brannan, along Brannan to Eighth, along

Eighth to and across Channel and Townsend, and so on along various thoroughfares to Railroad Avenue and Sixteenth Street in South San Francisco.

ELECTRIC Railway Development Co., of San Francisco have been incorporated with a capital stock of \$500,000. Directors: Dr. De Witt, Clinton Moore, George T. Dunlap, J. W. Dunlap, William M. Fitzmaurice and Ira V. Hitchcock.

THE San Francisco & Eastern Railway Co. have been incorporated for the purpose of operating a steam or electric railway from Alameda through El Tejon Pass to Rogers, a distance of 380 miles. The capital stock is \$14,000,000. J. R. Howell is the principal stockholder.

Sandusky, O.—An application for permission to build an electric street railroad from Soldiers' Home in Sandusky to Milan was presented to the Erie County Commissioners last month. The application was signed by H. C. Post, George Barney, W. H. Gilcher, J. C. Gilchrist, G. H. DeWitt and others.

Shanandoah, Pa.—The work of building the Mahanoy City, Shenandoah, Girardville & Ashland Electric Railway has been commenced. This line will be about eighteen miles in length and will connect the four towns. The contract for the building of the power house foundation has been awarded to August Kudel of Mahanoy City.

Staten Island, N. Y.—The Port Richmond & Prohibition Park Electric Railroad Co. have been incorporated, with a capital of \$50,000, for constructing a surface road about two miles in length. The largest stockholders are E. D. Clark of New Brighton and Isaac K. Funk of Brooklyn.

Steelton, Pa.—An electric street railway from Steelton to Middleton is now an assured thing. All the necessary stock has been subscribed and the negotiation closed for the right of way over the turnpike. Application for a charter will be made at once, and the work of constructing the road commenced as soon as possible. The road is expected to be finished by April 1, 1892.

Velasco, Tex.—An electric railroad will be built here by the Velasco & Surf Side Railway Co.

Equipment Notes.

J. F. Barry & Co. of New York City, have recently been appointed consulting and constructing engineers of the Atlantic Avenue Street Railway Co., Brooklyn, N. Y.

S. A. Day of New York has issued a circular to the public stating that Mr. W. H. Eckert has been appointed general agent for the sale of the well known Day Kerite insulated wires and cables.

The Newburyport Car Manufacturing Co., of Newburyport, Mass., have just finished five electric snow plows for Worcester, Mass., and three for Lawrence, Mass. Mr. James F. Shaw of this company has invented a self-lubricating trolley wheel, which is said to have a great many desirable features.

Chas. A. Schieren & Co., of New York, have recently shipped to the Franklin Electric Co., of Franklin, Pa., a twenty inch, perforated, electric, double ply leather belt. This order is a strong endorsement of the results attainable by the Schieren belts since the Franklin company have already a number of perforated electric belts in their works.

The Lewis & Fowler Manufacturing Co., of Brooklyn, have moved into their new building at 29 Walworth Street. The offices of the company occupy half of the entire second floor and are exceedingly commodious as well as very inviting. Arrangements seem to have been made for every department of this extensive company, and each person has been provided for. A view of the works of the Lewis & Fowler Company can be obtained from the rear windows of the new building.

The American Electrical Works of Providence, have sent to their many customers and friends a memento of the holiday season, consisting of an illuminated card, to which is attached a fir twig and minute cornucopia. Upon the card is printed the following message, "Xmas '91. We deeply regret that it is impossible for our many customers to be present with us at our Christmas festivities, but remembering and desiring to be remembered, we send a twig from our Christmas tree."

The Lee Composite Manufacturing Co. of New York are doing an excellent business in the sale of their products for railway use. The requirements to be met in a durable roof for smith shops and similar classes of railway buildings, has long been the aim of roofing experts. Acids and gases are constantly at work from the underside, while the atmospheric changes from without add to the difficulties. These conditions, however, seem to be fully met in the permanent brand of the composite manufactured by the Lee Composite Co. for this special purpose.

The Jewell Belting Co., of Hartford, Conn., have received the order for a sixty inch double belt and four sixteen inch double dynamo belts for the new station of the Newark Rapid Transit Co. of Newark, N. J.; also an order for two forty-eight inch, three ply belts for electric work. Their factory is very busy in the department for driving belts, and the following is a list of belts now in process of construction besides the ones mentioned above: 310 ft. of twenty-four inch double, 620 ft. of thirty inch double, 325 ft. of thirty-two inch double, 110 ft. of forty-inch three-ply, and seventy feet of twenty-six inch three-ply.

The Perfection Oil Purifier Co. of New York, have a purifier which is pushing to the front and they are consequently doing a thriving

business. The simplicity of their device is attracting the attention of users of oil and commending itself as a most practical solution of the question of purifying and saving dirty oil. All they ask is a trial to convince any doubters. Among their latest sales are purifiers to the Richmond Railway & Electric Co., Richmond, Va.; Allegheny County, Electric Light Co., Pittsburgh, Pa.; Edison General Electric Co., Schenectady, N. Y.; New York Life Insurance Co., New York; Post-office, Chicago, and others.

The John Stephenson Co., Ltd., of New York, have in their extensive factory cars for all parts of the world, almost. Among the shipments soon to be made are some cars for Mexico and Venezuela. Among the electric cars which this company are at work upon are a number for the Second Avenue line of Pittsburgh, Pa. The order for these was given November 21, and the first installment of five cars as shipped on the 22d of the following month. Among the cable cars in the works of the Stephenson company, are some for the Washington & Georgetown Railway Co. This order is for seventy grip cars, and one partly built shows that they will contain six benches, and will present a handsome and substantial appearance.

The Watts-Campbell Co., of Newark, N. J., have recently closed a contract with the William Clark Co., spool thread manufacturers of Pawcatuck, Conn., for a pair of twin tandem, compound, condensing engines with cylinders 22x40x60. These engines are capable of developing 1,200 H. P. The fly-wheel is twenty-six feet in diameter, 101 in. face, and is turned for four belts. The Watts-Campbell Co. are also building three tandem compound engines of 300 H. P. each for the Lynn & Boston Railway Co., and three tandem of the same dimensions for the Harlem Bridge, Morrisania & Fordham Railway Co., of New York, and two for the Trenton Electric Railway Co., of Trenton, N. J. The engines of this company are attracting much attention in the street railway line.

The Reliable Manufacturing Co., 53 State Street, Boston, have completed their large factory in Everett, Mass., and are now ready to fill all orders promptly for their celebrated Reliable sand box, which is claimed to be superior to any on the market. It has been adopted by many of the leading car builders and street railway companies in the country, and is rightly named, for it is reliable and can be depended upon to do the work required at any time with either wet, dry, coarse or fine sand. It is also very convenient to use in distributing salt. The Reliable Manufacturing Co. also manufacture the Collett ratchet brake. This is the only brake that does away with the revolving of the handle both in setting and letting off the brake. It embodies the elements of simplicity, facility of adaptation to any style of car without change in conditions, and unites strength with efficiency.

The Wightman Electric Co. of Scranton, Pa., have made a most satisfactory record in electric railway work during the past year, and the reports from the railroads using their system have been of a very gratifying character. During 1891 the Wightman company have taken contracts for a large number of car equipments for roads in Scranton, Easton and Altoona, Pa., Wheeling, W. Va., North Attleboro, Mass., Auburn, N. Y. and Cleveland, O. Besides their contracts for motors, the Wightman company have done an immense business in electric street railway supplies, their sales of the Wightman standard trolley wire insulators for the past year footing up in the thousands. The Wightman speed controller is also being rapidly adopted by many roads in connection with some of the other well known street railway systems. They say that the prospects for a splendid business during 1892 are most encouraging.

The Stillman Light Railway Development Co., of Providence, R. I., send us word of a test of their system, described in a recent issue of this JOURNAL. The rail system, during the test, was inserted in a short section of the main line of the Wood River Railroad at Hope Valley, R. I., where, sixteen times a day, it was subjected to the wear of trains drawn by twenty-two ton locomotives. The results of the test were quite satisfactory, testimony showing that the locomotives ran very smoothly over the track. The system, as will be remembered, is a compound one and consists of a steel rail resting on a split wooden stringer. Ties are placed seven feet between centres. The wooden stringer employed before being diagonally split has a size of 6x6 ins, the weight of rail being twenty-four pounds per yard. The stringers and rails break joints alternately so that a practically continuous rail is presented to wear.

H. Ward Leonard & Co. are licensing various manufacturing and construction concerns under Mr. Leonard's recently patented system of motor regulation. The basis of the license is a charge of \$2.50 per kilo-watt (roughly per horse power) in the motor. The royalty charge is not an annual charge, but is paid once for all in each case. Wm. Sellers & Co. have taken license under Mr. Leonard's patent on this basis, they agreeing to use the method upon all electric cranes they build in the future, during the life of the patent. The royalty is so small that the method will, no doubt, be rapidly introduced wherever it is applicable. H. Ward Leonard & Co. have secured the contract for wiring the Mail & Express building for 3,500 incandescent lamps, acting as sub-contractors under the Waddell-Entz Electric Co. They have also received an order from Wm. Sellers & Co., of Philadelphia, for two forty H. P. motors for use upon traveling cranes. The motors are to be supplied under rigid specifications, as to dimensions and performance.

The Ball Engine Co. of Erie, Pa., include the following in a list of their late shipments: Lawrence Gas & Electric Light Co., New Castle, Pa., one 150 H. P. single cylinder; Attica Electric Light Co., Attica, N. Y., one eighty H. P. single cylinder and one fifty H. P.; Citizens' Electric Light Co., Braddock, Pa., one 150 H. P. single cylinder; Youngstown Electric Light Co., Youngstown, O., one 350 H. P. cross compound, Pittsburgh & Birmingham Traction Co., Pittsburgh, Pa., one fifty H. P. single cylinder; Calif. Electric Light Co., San Francisco,

Cal., one 300 h. p. cross compound; Claremont Electric Light Co., Claremont, N. H., one eighty h. p. single cylinder; Johnstown Electric Light Co., Johnstown, Pa., one 200 h. p. single cylinder; Abington & Rockland Electric Light Co., North Abington, Mass., one 100 h. p. tandem compound; Edison General Electric Co., New York, two fifty h. p. single cylinder; Union City Electric Light Co., Union City, Tenn., one eighty h. p. single cylinder; Brush Electric Light Co., Cleveland, O., one thirty-five h. p. single cylinder; Loraine Electric Light Co., Loraine, O., one 100 h. p. single cylinder.

W. R. Fleming & Co., of New York City, representing the Harrisburg Foundry & Machine Works, are installing the "Harrisburg" Ide and Ideal engines as well as complete plants in many localities. The following are a few of the recent orders they have taken: For the H. W. Johns Manufacturing Co.'s new factory, South Brooklyn, two 125 h. p. horizontal, steel, single return-tubular boilers; Phillip Daly's Pennsylvania Club House, West End, N. J., a complete plant of sixty h. p.; Dunellin Electric Light Co., Bound Brook, N. J., complete plant of thirty-five h. p., Mr. Luther C. White, Waterbury, Conn., one 25 h. p. Ideal engine; Hotel "Marlborough," New York, one 100 h. p. "Ideal" engine; Mr. Jacob Rothchild, New York, one 35 h. p. Ideal; Hotel "Endicott," New York, two 100 h. p. Ideal engines. All of these contracts for engines were made with most rigid guarantees that the engines would run noiselessly and without vibrations. These people are making a specialty of this class of work, appreciating how important it is that there should be no noise or vibration whatever in plants for hotel and apartment house service.

The Page Belting Co. of Concord, N. H., with stores in New York, Boston, Chicago and San Francisco, are moving on with their business in the usual manner, increasing in all departments and report that among the large belts which they have recently shipped is one to Richmond, one to Madison, Me., and one to the Natick Electric Light Natick, Mass. Of their Acme link belts, among the street railway companies to which they have shipped during the past month, have been the following; the Chattanooga Electric Railway Co., Chattanooga, Tenn.; Shamokin Electric Street Railway Co., Shamokin, Pa.; People's Street Railway Co., Scranton, Pa. In the export business they have shipped to Havana, Russia, Brazil and Carracas. Of their Eureka dynamo belts, which is a double leather belt, slotted, they have shipped among others to the following electric companies: Austin Water, Light & Power Co., Austin, Tex.; Xenia Electric Light Co., Xenia, O.; Danbury & Bethel Gas & Electric Light Co., Danbury, Conn.; West End Street Car Co., San Antonio, Tex.; Home Electric Light & Steam Heating Co., Tyrone, Pa.; Shamokin Street Railway Co., Shamokin, Pa.; Johnstown Electric Light Co., Johnstown, Pa.

The Thomson-Houston Electric Co. of Boston, have a business which never seems to grow less, but is constantly increasing. Their railway supply department is now thoroughly established and meeting with great favor, and is prepared to furnish supplies of every description for electric railways, for line construction, car equipment and power stations. A number of railway companies have already manifested their appreciation of this new department, and express themselves as highly gratified at being able to obtain any particular device promptly forwarded upon receipt of order. The company have ample facilities for manufacturing the supplies they furnish, and many of the devices are the outgrowth of long experience in railway work and represent the latest inventions and improvements in their particular line. The large stock room which was secured for the supply department a few months ago is now filled with a very complete stock of railway supplies. Among the latest additions to the line of supplies is a steel gong or bell for cars, which the company guarantee to replace whenever one is broken. Mr. E. P. Morris, who is well known in connection with electrical work, and whose experience in street railway construction and operation renders him eminently fitted for the position, is in charge of this department, and is surrounded by a force of energetic and competent assistants.

The Berlin Iron Bridge Co., of East Berlin, Conn., have recently closed a contract with the Dry Dock Engine Co., of Detroit, Mich., for a new fire-proof modern machine shop to enable them to build the largest engines with the least expense and the quickest possible time. The machine shop when complete will be one of the finest on the great lakes and will compare favorably with any in the country. The plant will have modern appliances, such as electric cranes, two of twenty tons capacity running the whole length of the building, new machinery, electric lights, etc. The shop will be 201 ft. long \times 66 ft. in width overlapping the present quarters which will be torn down. The main portion of the building will be 200 ft. long, thirty-seven feet wide and fifty feet high in the clear, the two electric cranes running the whole length with thirty-eight feet of clear space above the floor. Large windows will be placed along the sides giving abundance of light, and skylight with twelve feet of clear glass will run along the whole roof. Three galleries twenty-eight feet wide will open out of the main shop, extending its entire length. The first two will be occupied by light machinery benches, and the top gallery will be arranged for the storage of patterns. Work on the new building will be begun immediately. Two-thirds of it will be erected in eight weeks and completed in ten. The remainder will be completed as soon thereafter as the old shop can be cleared away.

The Engineering Equipment Co., of New York, report some recent sales of Habirshaw wire aggregating 59,000 ft. showing that they are now considered in a position to handle this well-known wire at manufacturer's prices. In the line of span and guard wire they had sold up to December 18, the enormous quantity of 310,320 ft. to important railways now being constructed. They have also recently shipped nearly 60,000 ft. of hard fibre pipe, the sale of which they control, to points in New York, Pennsylvania and Tennessee. There are over 300,000 ft. of this pipe laid in Philadelphia, Buffalo and Detroit.

Among their customers in this line they number the New York Central & Hudson River Railroad Co. who use it to carry their signal wires. Reports received recently by the Engineering Equipment Co. show conclusively that every foot of the pipe now laid is giving full satisfaction. Some of this pipe has been down three years. Recent shipments by them of Anderson's electric railway specialties number 2,987 "Atna" insulators; 150 "Boston" trolleys, complete; of Anderson pull-offs, 536; terminals, 405; tree insulators, 925; hangers, 1,595; also miscellaneous shipments in considerable quantities of other Anderson specialties. All of the above were additional to direct factory orders. Besides these shipments the Engineering Equipment Co. report the following: 310 clips, 1,500 eye bolts, 7,500 rail bonds, 400 turnbuckles 500 bond clamps, 625 trolley ears, 150 curve insulators, 430 trolley bells, etc. The electric railway specialties of this company are peculiarly reliable and they will not knowingly commend nor sell cheap materials.

WESTERN NOTES.

The Knapp Electrical Works of Chicago, are receiving substantial orders from railway companies for feeder wire and general supplies.

Chas. Munson & Co., of Chicago, have recently furnished three sixty inch belts, each 127 ft. long, for the Louisville Electric Light Co., to take the place of belts of another manufacture.

The Illinois Steel Co., at their South Chicago works, produced during November 34,338 tons of steel rails, which is stated to be the largest output for a month in the history of the plant.

The Electrical Supply Co., of Chicago, are now making their own rawhide pinions. The company announce that a decided reduction has been made in the price of the Boston trolley and its parts, so that it does not now cost materially more than other trolleys.

The Patton Motor Car is operating successfully at Pullman, Ill. Thomas Saunders, general manager of the Patton company, says that three new cars will soon be built. They will be different in design from that of the present car, but no changes in mechanism will be made.

The Western Electric Co. of Chicago, have furnished for the Toledo Consolidated Street Railway Co. an electrical equipment for two cars now being operated upon the lines in Toledo. The motor is gearless and of the Eickemeyer type. The armature is a drum with seventy-four coils. The cars will be thoroughly tested on the Toledo system before additional motors are made by the Western Electric Co.

A. G. Hathaway, of Cleveland, O., manufacturer of the Hathaway patent transfer table, turn-table, etc., sends us word that among his latest contracts is one with the Riverside Worsted Mills, of Olneyville, R. I., which is the largest plant of its kind in the United States. His wheel press, described in another column of this issue is also meeting with a wide demand. The Hathaway appliances are now generally recognized as standard and essential parts of most street railway equipments.

The Shultz Belting Co., of St. Louis, number among their recent sales two woven leather link belts to the Citizens' Electric Railway Co., of Decatur, Ill.; one flat, forty-eight inch, double belt to the Municipal Electric Light & Power Co., of St. Louis, who installed a similar belt nineteen months ago, and two double belts, one thirty inches wide and 175 ft. long, and the other thirty-six inches wide and 210 ft. long, at Clinton, Mass. They have also supplied a number of other prominent manufacturing companies with belting recently.

The Columbia Incandescent Lamp Co., of St. Louis seem certainly to manufacture an electric lamp which is satisfactory for street railway use, if the many orders which they have on hand is any indication of the satisfaction which it gives in practice. This company write us that their factory has been running day and night for the last thirty days in order to supply the large demand for the lamp, although they have not a single traveling agent engaged in soliciting orders. The special claims made by this lamp company for their lamp are long life, combined with high efficiency and full candle power.

The Detroit Electrical Works of Detroit, Mich., have closed a contract for five additional thirty h. p. equipments with the People's Electric Railway Co. of Springfield, Ill. This road was equipped by them in the spring of 1891 with ten 30 h. p. motors, two additional equipments being purchased later. The present order makes a total of seventeen complete equipments for this road. Another recent contract by the Detroit Electrical Works is with the Kokomo Electric Railway Co., and is for five cars and one 80 kilo-watt generator of the type "B," the same which has done such good service at Nashville, Tenn., Gloucester, Mass., and South Chicago, Ill.

The American Car Co., of St. Louis, only recently established, is already making rapid progress. Their works, which are very large and complete, are thoroughly equipped with the most improved machinery and all modern appliances for handling a large business. This American company is at present busy on an order of 180 cable cars for the Washington & Georgetown Railway Co., of Washington, D. C., and their second order of thirty cars for the West Division Street Railway, of Chicago. This company report the outlook for the new year very promising, and they are receiving every encouragement from their railway friends. Mr. Wm. Sutton is president and Mr. Emil Alexander secretary. We wish them every success.

The Electric Merchandise Co., of Chicago, are, as usual, busy with their many orders. Good words spoken for a number of their specialties are coming in from many roads. Brand's steel wire track broom holders, Wardwell's track broom holders, Pratt's portable fare registers, and Burton electric heaters, are meeting with large sales. The latter have been placed upon electric roads in the following places the past month: Ottumwa, Iowa; Reading, Pa.; McKeesport,

Pa.; Cleveland, O.; Lincoln, Neb.; Martinsburg, W. Va.; Salt Lake City, Utah; Sioux City, Iowa; Marquette, Mich.; Wheeling, W. Va.; Quincy, Ill.; Williamsport, Pa.; St. Louis, Mo.; Ottawa, Can.; Wilkes-Barre, Pa.; Shamokin, Pa.; Bloomington, Ills.

The Pond Engineering Co., through their Chicago offices have recently closed a contract with the American Express Co. to install a 120 H. P. engine of their make in the building of that company. They have also closed a contract with the Laclede Gas Light Co., of St. Louis, for two 250 H. P. compound, condensing, Armstrong & Sims engines, with Blake pumps, and independent condensing apparatus. This work was awarded, after strong competition from all the leading high speed engines, to the Pond Engineering Co., who will put in the foundations and superintend the installation and starting of the plant. It is expected that one of these engines will be in operation by January 1, 1892, and the other shortly thereafter. The first engine will be belted direct to a 2,500 light alternator. The foundations will be carried to solid rock.

The Thomson-Houston Electric Co., through their Chicago office, have just closed a contract with the Benton-Bellefontaine Railway Co., St. Louis, for the equipment of thirty cars with two motors each, of the latest improved type, known as the W. P., or water proof. The contract also includes the furnishing of three 333 H. P. compound wound generators of the Thomson-Houston manufacture, and it is understood that the railway company will do everything that is required to make this installation model, complete and perfect in every respect. The Thomson-Houston Co. have their electric railway equipment in exclusive use in St. Louis on the following roads: St. Louis & Suburban, Union Depot, Mound City, Missouri Railroad, Suspension Bridge & East St. Louis, and it is now generally conceded that St. Louis has more Thomson-Houston electric railway apparatus in use than any other city in the United States, with the exception of Boston.

The Laclede Car Co., St. Louis, find themselves with plenty of orders at the beginning of the new year. At a recent visit of our representative he found them busy on the order of 375 cars for the Third Avenue (N. Y.) Railway Co. Two specimen cars of this order have already been delivered and are reported to be highly satisfactory to the Third Avenue company. These are models in every way of the latest improved street cars. They are thoroughly fitted and finely finished inside. There are to be 200 closed and 175 open cars. The closed cars are finished inside with mahogany and bird's eye maple, and are to be equipped with Baltimore trucks and running gear. The open cars will be equipped with the McGuire truck. The Pintsch system of gas lighting is used, which will add greatly to the appearance of the car when lighted, as well as to the comfort of the passengers. The Laclede company are improving their works and adding to their facilities, anticipating an unusually large amount of work during 1892, which they are in thoroughly good shape to handle.

The Electric Merchandise Co., of Chicago, have nearly completed the arrangements of their new offices at 11 Adams Street, which are pleasanter in every respect than the old quarters, having more room, light and better ventilation. The old location is still advantageously utilized for the storage and shipping of the lighter stock. A full line also of all their well known electric railway supplies is exhibited upon the ground floor. This company have received a letter from the Allentown & Bethlehem Rapid Transit Co., of Allentown, Pa., requesting the shipment of eight more heaters with switches, and stating that the heaters at present owned by the company are giving excellent satisfaction and are liked by the patrons of the road much better than the stoves. Orders have also been received from the Benson & Halcyon Heights Railroad Co., Omaha, Neb.; Edison General Electric Co., Portland, Ore.; Maschinenfabrik Oerlikon, Oerlikon bei Zurich, Switzerland; Newburyport & Amesbury Horse Railroad Co., Newburyport Mass.; Warrensburg Electric Light Co., Warrensburg, Mo. It is interesting to note that the Aspen Mining Co., Aspen Colo., have ordered four sets of electric heaters for use in the company's motor stations.

The Pullman Palace Car Co. are turning out an immense number of cars at their shops at Pullman, Ill. One of their street railway orders is for twenty cars for the City & Suburban Railway Co. of Portland, Ore. These cars will be delivered in sixty or seventy days. The Pullman company are now finishing one of their new double deck, centre vestibule cars for the City Traction Co. of Philadelphia. This style of car with its novel features promises to become very popular with street car companies. The one tried on the West End Railway of Boston has proved so extremely satisfactory that the railway company are thinking of purchasing a considerable number of these cars. In fact, they have requested figures from the Pullman company for the supply of 100 of these cars. The Pullman company will also furnish six motor car bodies for the Jacksonville (Ia.) Electric Railway. The cars will be finished in mahogany. The car which was built for the Judson Pneumatic Co. is now in operation at Pullman. The works are turning out large numbers of cars for steam railroads. One of the recent orders was for 4,000 freight cars and 100 passenger coaches for the Philadelphia & Reading road. When these are completed the Pullman company will have built 14,000 freight cars for the company. Twenty chair cars are to be built for the C., B. & Q., and the same number for the Rock Island road. For the Chicago & Eastern Illinois twenty-five ordinary passenger coaches are building.

The Central Electric Co., of Chicago, have just taken the agency for Illinois, Missouri, Nebraska and Indiana for the Interior Conduit & Insulation Co., and will carry in stock at Chicago, St. Louis, Kansas City and Omaha, a sufficient supply to meet the demands of the business. This is a very important agency, and the Central Electric Co. can be congratulated in securing it. Since taking the agency the company have secured an order for 50,000 ft. of one size of tube. It has started in well. Since undertaking the handling of elec-

trical supplies, the Central Electric Co. report a very considerable increase in this department of their very large general electrical supply business. Electric railroad men are coming to understand that they can get their goods promptly from this company, who carry a large stock, enabling them to make shipments promptly. The Central Electric Co. are headquarters for a number of first-class specialties, among which might be noted the porcelain break insulator, glass, high resistance insulator, special Candee feed wire, trolley hangers, etc., etc. Occupying a building of some 20,000 sq. ft. area, not one foot of which can be spared on account of the large stock constantly carried, this company assure their customers promptness in filling orders, and courteous treatment. This company have taken the agency for the Washington carbon and will carry a large stock. These carbons are designed for both high and low tension systems. They give long life and are perfectly straight and uniform. Shipments will be made from the Central Electric Co.'s stock and at factory rates.

A New Company.

The Wheeler Condenser & Engineering Co. have recently filed articles of incorporation with the Secretary of State, at Trenton, N. J. The company have bought out the entire plant and business of the Colwell Iron Works, at Cateret, N. J., which is one of the largest concerns in this country manufacturing vacuum pans, and special machinery for sugar refineries, salt works, condensed milk factories, etc.

Annual Meeting of The Burton Electric Co.

At a meeting of the Board of Directors of the Burton Electric Co. held December 15, at Richmond, Va., it was stated that since W. R. Mason of Chicago had become president of the company over 1,000 Burton heaters had been shipped. Eighty-five roads, it was also mentioned, were at that time using the heater, though at present the number is over 100.

A resolution was unanimously adopted expressing their entire appreciation and satisfaction of the zeal manifested by Mr. W. R. Mason, president of the company, in the management of its affairs.

A Company Goes Into Liquidation.

The Equitable Engineering & Construction Co., Philadelphia, announce that on the 1st of January they will go into liquidation. Their business for the past year has been a profitable one, but the active members of the concern wish to get out of the construction business. Mr. Ashton Hand has accepted a position as superintendent of the Detroit Electrical Works, and Mr. W. A. Stadelman wishes to devote his time for the present to his interests in Bristol, Tenn., which consist of the Bristol Belt Line Railway, and the Bristol & East Tennessee Railroad, in both of which he owns a controlling interest. The company advise us that they retire from business with every debt paid and a good balance to be distributed as a dividend to the stockholders.

The Astoria Electrical Manufacturing Co.

The Astoria Electrical Manufacturing Co., has been organized with a capital of \$500,000 for the manufacture of electrical machinery and apparatus, especially stationary and railway motors. The company have secured the ownership of the various patents upon improvements in electric railway motors which have been granted to Mr. W. M. McDougall and Mr. John Boothby. These patents cover a wide range. Offices have been taken at 14 Dey Street, New York. The officers of the company are as follows: President, Conrad N. Jordan; vice-president, William Steinway; treasurer, Herman Ridder; secretary, Chas. W. Spear; general manager, W. M. McDougall. Directors: William Steinway, Edward Uhl, Egerton R. Burpee, Herman Ridder, Conrad N. Jordan, W. M. McDougall, Chas. W. Spear.

A Chapter on Raw Hide.

It is a fair presumption that since gearing was first employed a desire has existed and efforts have been made to secure for it the important combination of noiselessness and durability. That this has at last been accomplished by the raw hide gearing is shown by the testimonials published by the New Process Raw Hide Co. from a cloud of witnesses, including eminent engineers, machinists and many street railway companies.

The din, rattle and racket of metal gearing used on many electric motor cars is accountable for a great part of the hostility to the extension of old and the building of new lines, and was one of the points recently most vigorously urged in opposition to electric cars for Brooklyn. Yet this noise is not a necessary adjunct to the conveniences and comforts which electric street cars alone provide, since the problem of how to "stop that noise" was solved when a way was discovered by which raw hide, without injury to its life or fibre, could be compressed, hardened and so treated that in the form of a gear or pinion it will do the work of steel. Such a process the New Process Raw Hide Co. claim to have, and that their gears and pinions have been doing active service on motor cars and in machine shops for the past three years.

The charge cannot be made that "these roads have no grades," and that "the conditions are all favorable." On the Federal Street & Pleasant Valley Passenger Railway, Allegheny, Pa., on the People's Railway of Scranton, the grades are remarkably heavy and frequent, the curves sharp, traffic heavy. Yet on these lines the gears in question

have been doing efficient service for the past two years and more; and on many others where the conditions are the opposite of favorable.

The following claims are made for them: They have the strength and endurance of steel; they are noiseless; they do not require lubricating, hence a saving of oil and labor; cleanliness is an accompaniment, no oil being used; they greatly reduce vibration, prolonging the life of the armature wires; they do not wear the gears with which they mesh—cannot possibly strip or otherwise injure them; are free from flaws.

New Publications.

New Stories Boiled Down for Busy Men. This is the title of a small circular issued by the Eureka Tempered Copper Co. of North East Pa., which contains, besides a few remarks about the tempered copper manufactured by this company, a number of very flattering testimonials from former and present customers.

A Few Testimonials; issued by the Burton Electric Co., and their selling agents, the Electric Merchandise Co. This circular gives a few of the many testimonials received by those two concerns from street railway companies, recommending the well known Burton electric heaters. The names of many prominent street railway companies appear as users of this appliance.

Combined Snow Sweeper issued by the Thomson-Houston Co.; This handsome publication which forms No. 1,001 of the bulletins of information issued by the Thomson-Houston Electric Co., is descriptive of the Thomson-Houston electric snow sweeper, shown at the Pittsburgh Convention and already illustrated in these columns. Three handsome engravings besides small cuts are given in the pamphlet, as well as a statement of the different types manufactured and the net prices to the customer.

Catalogue of Street Railway Cars issued by the St. Louis Car Co., of St. Louis, Mo This very handsome and carefully edited catalogue presents types of the many cars for cable, electric, horse and steam roads, manufactured by the St. Louis Car Co. The principal dimensions of each style of car are given with the illustration. The catalogue also includes a view of the St. Louis Car Co.'s electric snow plow, of their many types of trucks, car appliances, etc. The productions of this company are widely recognized as models of careful construction and intelligent workmanship.

Eighth Annual Report of the Bureau of Statistics of Labor in New York for the Year 1890. Submitted in 1891 by the commissioner, Charles F. Peck. In this volume of nearly 1,200 pages a great deal of space is occupied with the discussion of many "labor questions." Among these the eight hour day question takes up many pages and a variety of opinions, more or less logical; are quoted in favor of it by the commissioner. But four pages are devoted to the condition of street railway employes. The wages of drivers and conductors for a day of twelve hours seems to vary from \$1.50 to \$2.00. A more complete statement on the question of wages was given in the Sixth Annual Report.

The Monthly Record of Facts and Figures about Electric Railway Work; published by the Edison General Electric Co., Edison Building, New York. This publication, issued by the railway department of the Edison General Electric Co, is a new departure, and will contain information concerning the improvements which are from time to time made in the Edison system for electric railways, as well as important facts relating to the numerous electric railways which are being operated throughout the country. The first two numbers which have been issued present much interesting matter, and show that the railway department of that company is enterprising, pushing and bound to get its share of the business.

Report of the Board of Railroad Commissioners of the State of New York on Strains on Railroad Bridges of the State for 1891. Issued by the commissioners. Within a year from the establishment of the Board of Railroad Commissioners of the State of New York in 1883, it became evident that some measures should be taken to secure a more accurate report on the strains brought to bear on the members of the different railroad bridge trusses. For this reason a special department was organized and details are now obtainable of each railroad bridge in the state. The total number thus examined is about 25,000 not including the structures of the New York elevated railroad, the strains of which have also been calculated. 669 bridges have been criticised by the board, of which 535 have been repaired by the various companies and 134 entirely rebuilt.

Annual Report of the Postmaster General of the United States for the Fiscal Year Ending June 30, 1891. This exhaustive report sent to the President under date of November 30, 1891, covers 181 pages and contains much interesting information as well as a number of valuable suggestions and recommendations for the improvement of the service. Under the title Utilizing Street Cars in Cities, Mr. Wanamaker describes briefly the plan proposed in St. Louis, which we give more fully in another column. He also makes mention of the use of the inter-urban electric line at St. Paul and Minneapolis for carrying the mails, and recommends the use of electric cars in other towns for this service. As an example of a point where, he thinks, the electric cars could be utilized to advantage, the city of Wheeling, W. Va., is cited, from which place the towns of Benwood, Bellaire, Martin's Ferry and Bridgeport, O., could be easily served. The postal authorities are also proposing to install electric postal cars between the cities of Davenport, Ia., and Rock Island, Milan, and Moline, Ill. Among other recommendations made by the Postmaster General is one for a postal telegraph.

List of Street Railway Patents

ISSUED BY THE U. S. PATENT OFFICE, DECEMBER 1, 1891, TO DECEMBER 22, 1891, INCLUSIVE.

DECEMBER 1.

Bed Support for Railway Tracks, Edward R. Edwards, Mineral Ridge, O.	461,173
Car Axle, William S. Kisinger, Bellevue, Ky.	461,029
Car Starter and Brake, Frank J. Stafford, Cleveland, O.	461,111
Car Truck, James T. Robinson, Altoona, Pa.	464,041
Car Truck, Edgar Peckham, Kingston, N. Y.	461,253
Crossing for Trolley Wires, Robert M. Jones, Salt Lake City, Utah.	464,129
Electric Wire Support, Richard Ellison, Cincinnati, O.	464,298
Hanger for Trolley Wires, Thomas E. Adams, Cleveland, O.	464,411
Railroad Rail Fastener, James S. Peirce, Portsmouth, N. H.	464,150
Railway, Henry Day, Fairview, N. J.	464,455
Street Car, Geo. T. Chapman, White Plains, N. Y.	464,450
Trolley Wheel for Electric Railways, Smith W. Kimble, Denver, Colo.	464,370
Trolley Wire Hanger, Smith W. Kimble, Denver, Colo.	461,371

DECEMBER 8.

Cable Grip, Louis Kannenstine, St. Louis, Mo.	461,878
Car Brake, Henry F. Braun, Denison, Tex.	464,847
Car Brake, John Trendley, St. Louis, Mo.	461,596
Conduit Conductor for Electric Railways, Walter H. Knight, New York.	464,505
Drill for Electric Railways, Harry P. Bradford, Little Rock, Ark.	464,673
Electric Fare Recording System, Barton S. Molyneux, Minneapolis, Minn.	464,513
Electric Railway System, Leon O. Dion, Natick, Mass.	464,557
Rail Joint, Edward Samuel, Philadelphia, Pa.	464,793
Rail Joint, Milton C. Niles, Chicago, Ill.	464,702
Rail Joint, Milton C. Niles, Chicago, Ill.	464,696
Railway Rail Joint, Algernon G. Edmondson, San Buenaventura, Cal.	464,099
Removable Shoe for Cable Car Grips, Charles Fitzgerald, Pittsburgh, Pa.	464,924
Street Railway, Whitcomb L. Judson, New York, N. Y.	464,614
Street Railway, Whitcomb L. Judson, New York, N. Y.	464,615
Street Railway, Whitcomb L. Judson, New York, N. Y.	464,616
Transmitting Mechanism, for motor cars, Charles W. Thomas, Jersey City, N. J.	464,640
Trolley for Electric Railways, John W. Schlosser, Washington, D. C.	464,780

DECEMBER 15.

Bracket for Supporting Electric Conductors, John A. Duggan, Quincy, Mass.	461,365
Car Brake, James T. Robinson, Altoona, Pa.	465,389
Converter System for Electric Railways, Mark W. Dewey, Syracuse, N. Y.	465,359
Electric Car Brake, Edmond Verstraete, St. Louis, Mo.	465,034
Electric Railway, George F. Green, Kalamazoo, Mich.	465,407
Electric Railway, George F. Green, Kalamazoo, Mich.	465,432
Fender for Street Railway Cars, Robert H. Marsh, Boston, Mass.	465,383
Momentum Reservoir Motor, Marlon M. Bailey, Denver, Colo.	465,122
Pick-up and Throw-off Mechanism for Cables, George Muller, Hoboken, N. J.	465,191
Rail Chair, George E. Walls, Philadelphia, Pa.	465,223
Sliding Railway, Charles A. Barre, Paris, France	465,151

DECEMBER 22.

Cable Grip Car Truck, Ernest R. Esmond, New York, N. Y.	465, 659
Car Truck, Ernest R. Esmond, New York, N. Y.	465, 658
Car Truck, Ernest R. Esmond, New York, N. Y.	465, 660
Electric Railway, William H. Applegate, Atlantic, Ia.	465, 613
Electric Railway Trolley, Charles S. Foster, Whitesborough, N. Y.	465, 469
Electric Railway Trolley, Frank J. Sprague and Patrick F. O'shaughnessy, New York, N. Y.	465, 806
Gearing for Electric Motor Cars, Owen F. Evans, Columbus, O.	465, 592
Guard for Trolley Wire Insulators, Francis O. Blackwell, Lynn, Mass.	465, 447
System of Street Car Propulsion, Frederick G. Wheeler, New York, N. Y. (reissue).	11, 211
Steam Generator for Street Cars, Frederick G. Wheeler, New York, N. Y. (reissue).	11, 212

We will send copies of specifications and drawings complete of any of the above patents to any address upon receipt of twenty-five cents. Give date and number of patent desired. STREET RAILWAY PUBLISHING COMPANY, WORLD BUILDING, NEW YORK.

Caution.

To all whom it may concern:

We beg leave to call your attention to U. S. Patent No. 287,861, dated November 6th, 1883, under which we manufacture "our noiseless" rawhide gears of steer hide and cured by our patented process.

As the owners of this Patent, we claim the sole right to manufacture and sell rawhide gears "composed of several layers of rawhide, each having the flesh side removed, and all suitably and securely joined together;" and in order that all may be aware of our rights and not feel aggrieved if sued for infringement upon our rights, we hereby notify all interested parties that we shall prosecute all infringers whether they be makers, dealers or users.

"The owner of a valid patent secures by virtue thereof three substantive rights, the right to make, the right to sell, and the right to use the patented article. He who invades any of these rights is an infringer."

Birdsell v. Shalolo, 112 U. S., 485.

Tuttle v. Mathews, 28 F. R., 98.

THE NEW PROCESS RAWHIDE CO.,
October 28th, 1891. Syracuse, N. Y., U. S. A.

QUOTATIONS OF STREET RAILWAY STOCKS.

BOSTON STOCKS.—Corrected by R. L. DAY & Co., 7 Exchange Place, Members of Boston Stock Exchange. Dec. 18.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Rows include West End Pref. and West End Com'n.

PROVIDENCE STOCKS.—Corrected by CHACE & BUTTS, Bankers, Providence, Dec. 18.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Rows include Pawtucket St. Ry. Co., Union R. R. Co., Providence Cable Tramway.

HOLYOKE STOCKS.—Corrected by J. G. MACINTOSH & Co., Bankers, Holyoke, Mass. Dec. 18.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Rows include Springfield Street R. R. Co., Holyoke Street R. R., Northampton Street R. R.

CHARLESTON STOCKS AND BONDS.—Corrected by A. C. KAUFMAN, Charleston, S. C., Dec. 18.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes sections for STOCKS and BONDS.

NEW ORLEANS STOCKS AND BONDS.—Corrected by GEORGE LE SASSIER, 174 Common Street, New Orleans, La., Dec. 18.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes sections for STOCKS and BONDS.

NEW HAVEN STOCKS AND BONDS.—Corrected by H. C. WARREN & Co., Bankers and Brokers, New Haven, Conn. Dec. 18.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes sections for STOCKS and BONDS.

BROOKLYN STOCKS AND BONDS.—Corrected by C. E. STAPLES & Co., 215 Montague Street, Brooklyn, Dec. 18.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes sections for STOCKS and BONDS.

ALBANY STOCKS AND BONDS.—Corrected by SPENCER TRASK & Co., Bankers and Brokers, corner State and James Streets, Albany, N. Y., Dec. 18.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes sections for STOCKS and BONDS.

*In bonds buyer pays accrued interest.

NEW YORK STOCKS AND BONDS.—Corrected by H. L. GRANT, 26 Broad St., New York, Dec. 18.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes sections for STOCKS and BONDS.

MONTREAL STOCKS AND BONDS.—Corrected by GORDON STRATHY & Co., Members Montreal Stock Exchange, 9 St. Sacrament Street, Dec. 18.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes Montreal St. Ry. (p'd up sh.) and Montreal St. Ry. bonds.

LOUISVILLE STOCKS AND BONDS.—Corrected by ALMSTEDT BROS. Stock and Bond Brokers, 510 West Main Street, Louisville, Ky., Dec. 18.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes Louisville St. Ry. Co., pref. and Louisville St. Ry. Co., com. bonds.

CHICAGO STOCKS AND BONDS.—Corrected by WILLIAM B. WRENN, 82 Washington Street, Chicago, Ill., Dec. 18.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes Chicago City, Chicago Passenger, North Chicago City, and various Chicago bonds.

PITTSBURGH STOCKS AND BONDS.—Corrected by REA BROS. & Co., 115 Fourth Avenue, Pittsburgh, Pa., Members of New York, Philadelphia and Pittsburgh Stock Exchanges, Dec. 18.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes Central Traction R. R. Co., Citizens' Traction R. R. Co., and various Pittsburgh bonds.

SAN FRANCISCO STOCKS AND BONDS.—Corrected by PHILIP BARTH, Broker, 440 California Street, San Francisco, Cal., Dec. 18.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes City R. R. Co., California St. Cable Co., and various San Francisco bonds.

ST. LOUIS STOCKS AND BONDS.—Corrected by JAMES CAMPBELL, Banker & Broker, 307 Pine st., St. Louis, Mo., Dec. 18.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes Benton-Bellefontaine, Cass Ave. & Fair Grounds, and various St. Louis bonds.

PHILADELPHIA STOCKS AND BONDS.—Corrected by ROBERT GLENDINNING & Co., 143 So. Fourth st. (Bullitt Building), Philadelphia, Dec. 18.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes Citizens', Continental, Frankford & Southwark, and various Philadelphia bonds.

OMAHA STOCKS AND BONDS.—Corrected by RICHARD C. PATTERSON, Banker and Broker, 907 N. Y. Life Building, Omaha, Neb., Dec. 18.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes rows for Omaha St. Ry. Co. (Stocks) and Omaha St. Ry. Co. (Bonds).

CLEVELAND STOCKS.—Corrected by W. J. HAYES & SONS, Bankers, Cleveland, O., Dec. 18.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes rows for Broadway & Newburgh R. R., Brooklyn St. R. R., Cleveland City Cable, etc.

CINCINNATI STOCKS AND BONDS.—Corrected by GEO. EUSTIS & CO., Bankers and Brokers, 26 West Third Street, Cincinnati, Dec. 18.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes rows for Cincinnati (Stocks) and Cincinnati Street, Mt. Adams & Eden Park, etc. (Bonds).

BALTIMORE STOCKS AND BONDS.—Corrected by HAMBLETON & CO., Bankers, 9 South Street, Baltimore, Md., Dec. 19.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes rows for Balto. City Pass. Ry. Co., Union Pass. Ry. Co., etc. (Stocks) and Central Pass. Ry., Union Ry. Co., etc. (Bonds).

WASHINGTON STOCKS AND BONDS.—Corrected by CRANE, PARRIS & CO., Bankers, 1344 F Street, N.W., Washington, D. C., Dec. 18.

Table with columns: Company, Par., Capital, Period, % last div., Date of Issue, Bid, Ask'd. Includes rows for Wash'ton & Georgetown R. R., Metropolitan R. R., etc. (Stocks) and Washington & Georgetown, do. do. convert., etc. (Bonds).

Financial.

THE Altoona (Pa.) City Passenger Railway Co. will issue \$50,000 of bonds.

THE Cincinnati (O.) Street Railway Co. have voted to increase their capital stock from \$6,000,000 to \$6,750,000.

THE Denver (Col.) Lakewood & Golden Railway Co. have decided to increase the capital of the road from \$600,000 to \$1,000,000.

THE earnings of the Atlanta Consolidated Street Railway Co. for October were reported to be \$37,302, against \$35,136 last year.

The net earnings of the West End railway, of Boston, in October, are reported as \$173,000, an increase, it is said, of \$36,000 over 1890.

THE Oshkosh (Wis.) Street Railroad Co. have filed an amendment to their articles of incorporation increasing their capital from \$60,000 to \$100,000.

THE stockholders of the Columbus (O.) Consolidated Railway Co. have decided to increase the capital stock of the company from \$250,000 to \$1,250,000.

THE Rutland (Vt.) Street Railway Co. on December 1 retired bonds numbering 11 to 20 inclusive. There still remain unpaid bonds to the amount of \$26,000.

THE new managers of the Rome (Ga.) Street Railway Co. have decided to make a new issue of bonds. The amount is \$100,000 bearing interest at six per cent.

THE report to the State Commission of the Cottage City (Mass.) Street Railway Co.: Total earnings, \$2,666.15; running expenses, \$2,261.68; net earnings, \$404.47.

At a meeting of the Board of Directors of the Lebanon (Pa.) & Annville Street Railway Co. the capital stock of the company was increased from \$60,000 to \$100,000.

THE International Trust Co. of Boston have made application in the Superior Court for the appointment of a receiver for the Keokuk Electric Street Railway & Power Co.

THE stockholders of the Redlands (Cal.) Street Railway Co. will vote January 23, 1892, on the question of increasing the capital stock of the company from \$50,000 to \$75,000.

THE St. Louis (Mo.) Collinsville & Carondelet Railway Co. have filed for record a resolution of the bondholders authorizing the directors to issue 1,500 bonds of \$1,000 each, payable July 1, 1931.

THE Laramie City (Wyo.) Tramway Co., of which F. M. McHale, of Denver, is president, has just issued \$60,000 in bonds, secured by a first mortgage upon their property. The Title Guarantee & Loan Co. are named as the trustee.

THE Dubuque (Ia.) Electric Railway, Light & Power Co. have given a second mortgage for \$50,000 on their plant to cover the floating indebtedness caused by the building of the South Dodge Street and other branch lines. The first mortgage is for \$200,000.

THE \$100,000 deposited by the Lake Street L Co., of Chicago, with the city treasurer as a guaranty that the road would be built, is to be returned to the company, and the city gets a bond in the penal sum of \$200,000 on condition that the road is completed according to the ordinance.

THE total receipts for 1891 of the Citizens' Traction Co., of Pittsburgh, including \$300,000 from new stock were \$962,223.31. The total expenditures, including Sharpsburg electric construction and equipment and dividends, were \$905,741.74. Cash balance November 1, 1891, \$56,481.57.

AT the last annual meeting of the Philadelphia Traction Co. it was voted to increase the capital stock, now \$500,000,000 to \$800,000,000 by authorizing the issue of 60,000 additional shares from time to time as the directors may determine. It is understood that \$1,000,000 of stock, or 20,000 shares, will be issued during the coming year. The par value of Traction shares is \$50, with \$40 per share paid on the existing stock. During the past year the Traction company carried 68,675,451 passengers, and had \$3,552,364 earnings and \$3,246,050 expenses, leaving \$306,314 net earnings.

\$ \$ \$

THE applications to the bankers for the \$2,000,000 issue of bonds of the Baltimore City Passenger Railway Co., offered at 102½ and interest, was largely in excess of the amount for sale. The bonds were dated November 2, 1891, bear interest at five per cent., payable May and November 1 in gold, and run twenty years. The average net earnings of the company for the past ten years, as stated in the bond circular, have been \$133,775 51 a year, or \$1,337,775.10 for the whole period, being \$337,775.10 in excess of the amount required to pay the interest on the bonds for a corresponding period. The company during the last ten years, besides spending large amounts for betterments, property and extensions, have paid dividends of from ten to thirteen per cent per annum.

\$ \$ \$

THE directors of the West End Street Railway Co., Boston, last month declared dividends of four per cent. upon the preferred stock and five per cent. upon the common stock, payable January 1, 1892, to stockholders of record December 19, 1891. The full board of directors elected at the last annual meeting was as follows: G. T. W. Braman, Isaac T. Barr, T. Jefferson Coolidge, Joseph S. Fay, Jr., Eustace C. Fitz, Henry D. Hyde, Walter Hunnewell, E. D. Jordan, Samuel Little, William Powell Mason, Theophilus Parsons, Dexter N. Richards, Nathaniel Thayer, Walter S. Swan, Henry M. Whitney. The new members are Messrs. Mason, Coolidge, Parsons, Hunnewell and Thayer. From figures based upon past records the surplus of this company for the six months ending December 31, 1891, after paying all fixed charges and dividends upon both preferred and common stocks, it has been estimated, will be fully \$150,000.

The Westinghouse Reorganization.

The plan of reorganization adopted by the Board of Directors April 14, 1891, and by the stockholders July 15, 1891, has been completed for some time. The stockholders have responded with substantial unanimity to the call for the surrender of forty per cent. of their holdings for the use of the company. Of the stock at the disposal of the company, \$4,000,000 has been converted into seven per cent. preferential, cumulative stock and the balance into "assenting stock," entitled after the preferred stock, to a seven per cent. annual preference. Provision has been made for the company's debt and working capital by the sale at par of \$3,000,000 of the preferred stock, for which payment in full has been received.

The company have acquired almost all of the stock of the United States Electric Lighting Co. and the Consolidated Electric Light Co. (commonly referred to as the "leased companies"), so that the fixed charges formerly incident to the lessee of those companies are now substantially obliterated, and the consolidation of interests thus effected has rendered possible a great reduction in general expenses. The saving in interest upon debt, rentals and other fixed charges, thus effected by the reorganization, amounts to more than \$400,000 per year. All this has been accomplished without increasing the company's capital stock (\$10,000,000), of which over \$1,000,000, common and preferred, still remains in the treasury for future use. The reorganization has been effected without litigation and without interruption to the business, the three factories having been kept in continuous operation. The company have never been so favorably situated for work as now, and they have every prospect for a large and profitable business.

A Large Ammeter.

The Weston Electrical Instrument Co., of Newark, N. J., have taken a contract to build a 5,000 ampere ammeter for the Wilson Aluminum Co., of Leaksville, N. C. This instrument is to be a very large form of the well known Western type of ammeter, with some important modifications to meet the peculiar requirements of the case. It will have a scale about fourteen inches long, which will be divided into 250 parts. Each division will equal twenty amperes and the divisions will be large enough to be easily read to tenths or two amperes, and with care to one ampere. The scale will be laid by actual calibration to the full current to be measured by the instrument in practical work, namely 5,000 amperes.

This may seem a somewhat astonishing thing for the Weston company to do, especially when we consider the work which is commonly done by the use of a current of 5,000 amperes. Nevertheless, it is not beyond the facilities of the Weston Electrical Instrument Co. to construct such an instrument in the regular course of their work, without a single change in their appliances or any special preparation. The appliances of the Weston company for standardizing work are generally known to be excellent, and some idea of the perfection of the company's plant can be formed when we state that the copper conductors in the laboratory for handling ammeter work, weigh about four tons, and that some of the mains have a sectional area of five square inches, and that they are capable of carrying a current of 10,000 amperes without inconvenient heating.

A New Engineering Firm.

A corporation known as Sprague, Duncan & Hutchinson (Limited) has been formed in New York, with offices at 15 Wall Street, to carry on the work of consulting electrical engineers. The gentlemen composing this company are well known in both the street railway and electrical fields.

The senior member is Mr. Frank J. Sprague, inventor of the Sprague motor, and one of the foremost pioneers of the electrical street railroad and a well-known authority on rapid transit by electricity. Dr. Louis Duncan has for a long time been head of the electrical department of the Johns Hopkins University of Baltimore, and his authority as an expert on electrical matters has been widely recognized. Dr. C. T. Hutchinson was Mr. Sprague's assistant in the Sprague Electric Railway Motor Co., and thereafter assistant to the chief engineer of the Edison General Electric Co.

We wish the new corporation all the success in their line of work which they deserve.

What the Papers Say About It.

This road has long been noted for the beauty of its scenery, the elegance and comfort of its equipment, and as the greatest through car line on the American continent.

The main line is 450 miles in length and connects the cities of Chicago and Buffalo, with branch lines to the oil regions of Pennsylvania, Fort Wayne, Ind., and to the flourishing cities of Detroit, Jackson, Lansing, Kalamazoo, and Grand Rapids in Michigan. The main line passes through such important cities as Dunkirk, N. Y., Erie, Pa., Cleveland, Sandusky and Toledo, O., Adrian, Hillsdale, Mich.; and Goshen, Elkhart, South Bend and La Porte, Ind.

The roadbed is unsurpassed by any line in the country, and under the great improvements made during the past two years in the way of reducing curves and grades, the Lake Shore is to-day a line practically without a grade or a curve, a thoroughly constructed double-track railway, facts which give increased popularity and which have made it the favorite passenger line between the East and West, standing in the front rank among the great transportation companies of the world, a shining example of the careful, considerate, and progressive policy of its management, the double tracks permitting of a high rate of speed with entire safety, the perfect roadway giving ease and comfort to its patrons.

The equipment of its trains is, indeed, of a very high order of excellence. The sleeping, drawing-room and dining cars are of Wagner build, and nothing which the ingenuity of man could suggest for the comfort and welfare of passengers is omitted in their make-up.

The Lake Shore enjoys the distinction of being the line selected by the United States Government as the route of the fast mail trains—three daily trains being devoted almost exclusively to this branch of business—and forms in connection with the New York Central & Hudson River Railroad the greatest through mail line in the world, the line between New York and Chicago. No higher compliment could be paid to its management, and the road certainly merits the trademark it has adopted—the mail pouch.

The country traversed by it represents the richest portion of the Middle States. Its connections with other railways being made in almost every case in Union passenger stations of necessity calls to its line the people from a large territory tributary to its own immediate neighborhood. Its universally recognized excellent through train service between the cities of New York, Boston and Chicago, which has recently been increased by the addition of two new trains making thirteen through trains between the cities mentioned, ten of which are daily, has attracted the attention of people throughout the Eastern country and in Europe.

The magnificent passenger station on Van Buren Street, occupies a central position in the city of Chicago, convenient to all hotels, banks, postoffice and street railway lines, and secures to travelers immunity from the annoyance of a long transfer across the city.

Another cause of the Lake Shore's popularity is the fact that it is the only line conveying passengers over the four track New York Central into the City of New York without a ferry transfer.

WE PURCHASE

Total Issues of Street Railway Bonds.

CORRESPONDENCE INVITED.

N. W. HARRIS & CO., BANKERS,

163 Dearborn Street Chicago,
15 Wall St., New York. 70 State St., Boston.

SPECIAL NOTICES.

FOR SALE.

FOR SALE.—30 twelve-foot cars, one-end type, with one fare box; in fair order. Gauge 4 ft. 8½ in. For all particulars apply to METROPOLITAN RAILROAD CO., Washington, D. C.

FOR SALE.—Street Railway, (4 miles), operated with horses, in a growing manufacturing city of 20,000, East of the Alleghenies. For particulars write to "BUELING," care STREET RAILWAY JOURNAL.

FOR SALE—STREET CARS.—On account of increase of business calling for larger cars, we have for sale 9 twelve-foot double-end, box cars, with fare box in each end. Gauge 4 feet 8½ inches. Apply to UNION STREET RAILWAY CO., New Bedford, Mass.

FOR SALE.—11 standard gauge, very light, ten-foot Double End Street Cars—Built by Stephenson. Seat 12. Repaired and repainted in excellent manner. Price \$300 each. Cash or part cash; balance on installments. HUMPHREYS & SAYCE, 10 Wall St., New York.

POSITIONS WANTED.

WANTED.—By an electrical engineer familiar with all branches of the profession and expert in experimental work, particularly telegraphic and telephonic. Is desirous of engaging with parties who have new invention or system to develop and introduce. Has had extensive practice in Europe, both with apparatus and with patents. Practical operator, long experience, best references, modest expectations. Address "MULTIPLEX," care STREET RAILWAY JOURNAL.

WANTED.—By a thoroughly practical mechanical and electrical engineer, a position as superintendent or manager of an electric road. To any company about changing from horse to electric power, I will guarantee a great saving. Am competent to purchase and install both steam or electric plants of the best for the least money. Can furnish 15 years' references, which will include my record as an occasional manager and a reliable man whose whole time is given to the interests of any company by whom I am employed. Address "ECONOMICAL MANAGER," care of STREET RAILWAY JOURNAL. 3

FOR SALE.

125 tons second-hand 33 lb steel tram rails, in excellent condition.
100 tons second-hand 25 lb steel T rails, but little used.

D. E. GARRISON & CO., - - 219 N. 4th St. Louis, Mo.

FOR SALE CHEAP. FARE BOXES.

G. I. M. Slawson Fare Boxes, 4 Wales Manufacturing Co.,
Fare Boxes Will be Sold Very Cheap by the

OSWEGO STREET RAILWAY CO.,
OSWEGO, N. Y.

CAR AND CARRIAGE MANUFACTURERS

Should write for

SAMPLE BOX OF NATURAL RUBBING STONE.

SENT FREE OF CHARGE. CHARGES PREPAID.

Does not scratch or clog on the surface, and cuts rapidly. Sold on positive guarantee to give satisfaction.

A. L. SIMMONS, - Geneseo, N. Y.

ACTUAL PRACTICE HAS SHOWN THAT THE
UNDERGROUND SYSTEM OF THE

Interior Conduit & Insulation Co.

FILLS A LONG FELT WANT, ESPECIALLY FOR
STREET RAILWAY WORK.

For Price Lists, data, etc., etc., write to

INTERIOR CONDUIT & INSULATION CO.,

EDWARD H. JOHNSON, President. WORKS: {527 to 531 West 34th St.
{526 to 528 West 35th St.

General Offices: 42 and 44 Broad St., New York.

—OR TO—

THOS. DAY & Co., 222 Sutter Street, San Francisco, Cal.
MOUNTAIN ELECTRIC CO., Denver, Col.
AMERICAN ELECTRICAL SUPPLY CO., 226 Pearl Street, Buffalo, N. Y.
PUTNAM, GAY & Co., 27 East Main Street, Rochester, N. Y.
GLOVER ELECTRIC CO., 127 West 8th Street, Cincinnati, O.
CHARLES GABRIEL, Saginaw, Mich.
SOUTHERN ELECTRICAL MANUFACTURING & SUPPLY CO., 110 Baronne St., New Orleans, La.
WALKER & KEPLER, 531 Chestnut Street, Philadelphia, Pa.
ELECTRICAL SUPPLY & CONSTRUCTION CO., Pittsburgh, Pa.
SOUTHERN ELECTRIC CO., Baltimore, Md.

FOR SALE.

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